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OLDMAN RIVER DAM

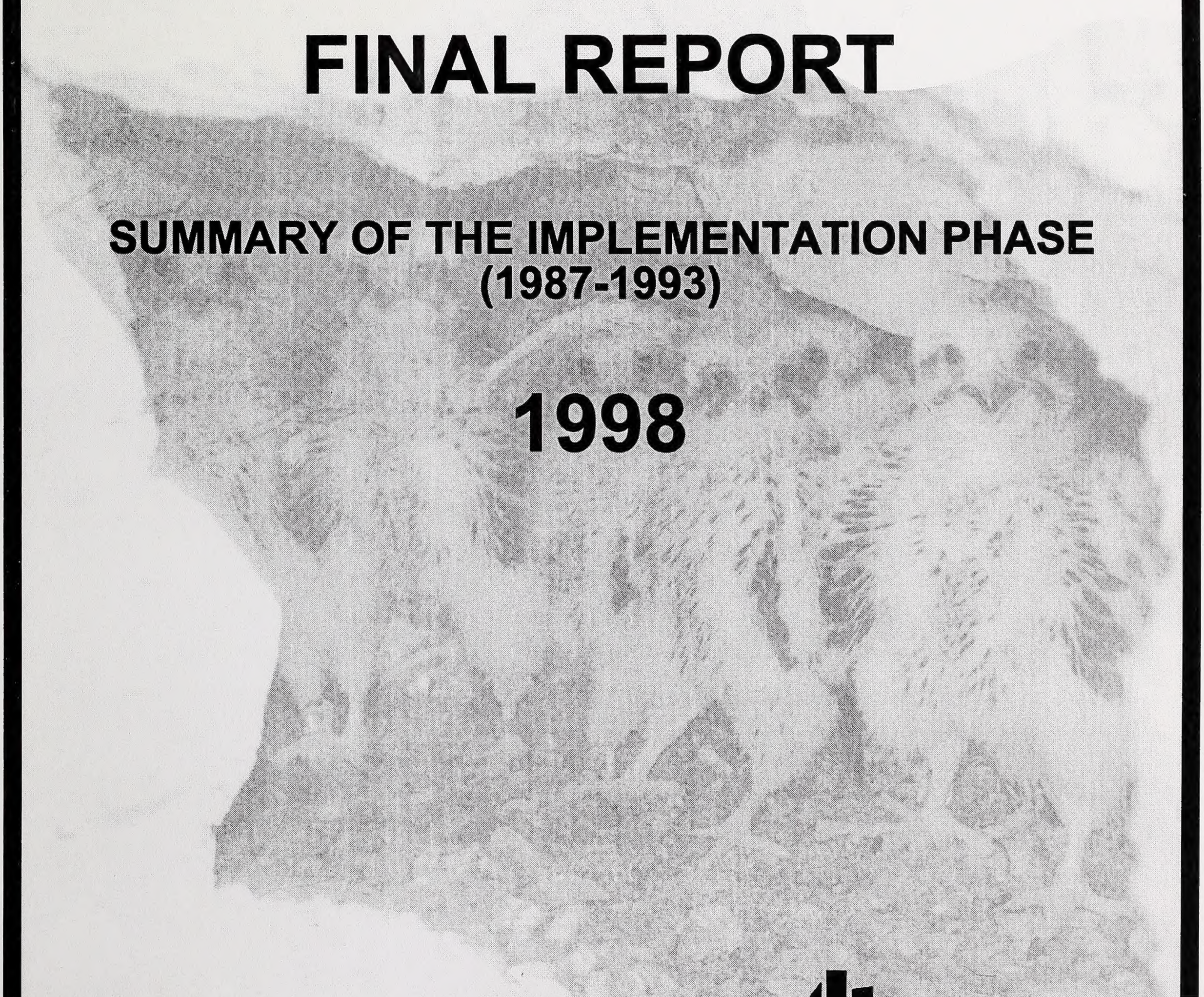
WILDLIFE HABITAT MITIGATION PROGRAM

PINCHER CREEK, ALBERTA

FINAL REPORT

SUMMARY OF THE IMPLEMENTATION PHASE
(1987-1993)

1998



Alberta

PUBLIC WORKS, SUPPLY AND SERVICES

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EXECUTIVE SUMMARY

This report summarizes the implementation phase (1987 to 1993) of the Oldman River Dam Wildlife Habitat Mitigation Program, and describes the development and construction of wildlife habitat projects, and the monitoring undertaken to provide baseline habitat and population conditions. The program cost approximately $4,000,000, including $1,100,000 for land and $600,000 for design and monitoring costs. This report includes an inventory of completed projects, the results of the program, the project manager's perspective on the mitigation methods used, and provides recommendations for future management of the land base.

A project land base of 2829 ha surrounds the 2132 ha Oldman River Reservoir and is managed as a Provincial Recreation Area. This land base comprises native grasslands, shrubs and forest communities on the river valley slopes and coulees adjacent to the reservoir.

Perimeter fencing installed around most of the project limits public access and permits controlled grazing. Cross-fencing installed within the land base facilitates managed grazing of selected parcels. Wooden slat snow fence installed on the windward side of all tree and shrub plantings reduces wind stress and improves ground moisture conditions. High wildlife fences installed where roads cross the reservoir direct deer away from the bridges to safer road crossing locations. High wildlife fence enclosures provide a means to evaluate browse damage by deer on planted and regenerating shrubs and trees.

Sixty-one new wetlands were created and eight existing sloughs or dams were acquired for the project. Fourty-three of the new wetlands function as designed. Water is pumped to fill seven new wetlands and five existing sloughs.

Shrub recovery on the project land base has the potential to substantially improve wildlife habitat in the long-term. Planted native tree and shrub seedlings and rooted cuttings have had limited success. Plantings and recovering species are expected to provide sufficient replacement habitat.

Habitat Evaluation Procedure models estimate 279 habitat units of mule deer cover were lost when the reservoir was flooded and 164 to 226 habitat units of mule deer cover will be created once the enhancement projects reach maturity.

Replacement nesting sites have been very successful. Prairie falcons, geese and owls use nest cavities excavated in unoccupied cliffs. Ferruginous hawks, red-tailed hawks and ospreys use nesting platforms installed in coulees around the reservoir. American kestrels, wood ducks, and western mountain bluebirds use nest boxes installed near wetlands and along fencelines.

Since implementation of the Wildlife Habitat Mitigation Program, diversity of bird species has increased on the project land base as have populations of waterfowl and mule deer.

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1.0 INTRODUCTION

The Alberta Government spent two decades developing the Oldman River Dam Project (ORD). Public attitudes towards resource development changed significantly during that period. Society became more aware of and concerned with, the environmental and social impacts of resource development. The Oldman River Dam Project became a focal point of a debate over the acceptability of resource developments in the context of environmental protection.

The Wildlife Habitat Mitigation Program was implemented to offset the negative impact of the construction and operation of this project on plant and animal species. This program, in combination with the fisheries, recreation, historical resources and the social impact programs, formed the social and environmental mitigation program for the project.

Responsibility for operation and monitoring of the Wildlife Habitat Mitigation Program was transferred from Alberta Public Works, Supply and Services (APWSS) to Alberta Environmental Protection (AEP) in 1992. This is the summary report on the implementation phase (1987-1993) of the program.

This report contains

- a summary of the process that led to the final program design,
- a summary of the projects undertaken to complete the Wildlife Habitat Mitigation Program,
- a summary of the design strategies from the *Strategy*[1] and the proposed habitat mitigation projects from the *Action Plan*[2],
- an evaluation of the program's success in meeting the objectives of the *Strategy* and commitments of the *Action Plan*,
- an initial evaluation of the mitigation techniques used in the program,
- a recommended strategy for future management of the program,
- a consolidated list of references used in the development of the program,
- a selection of project photographs,
- the habitat suitability index models,
- executive summaries of selected reports,
- a summary of the vegetation mapping, and
- the grazing management plan.

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[1] The Delta Environmental Group Ltd. 1989. *A Strategy for Wildlife Habitat Mitigation in the Oldman River Dam Reservoir.*

[2] Alberta Public Works, Supply and Services and The Delta Environmental Group Ltd. 1989. *An Action Plan for Wildlife Habitat Mitigation for the Oldman River Dam Reservoir.*

Detailed record drawings and data sheets for the individual program components are be found in two companion reports:

- *Oldman River Dam Project Wildlife Habitat Mitigation Program, Final Report, Field Data Sheets, 1994* and
- *Oldman River Dam Project Wildlife Habitat Mitigation Program, Final Report, Record Drawings and Photographs, 1995.*

This report contains some baseline population data. It does not contain data on the responses of wildlife populations to the mitigation program. Wildlife response and program performance monitoring are being undertaken and reported on by AEP.

This report was prepared to document the implementation of the program, to provide early results and to assist in the evaluation of the program. An Environmental Advisory Committee has been appointed by the Minister of Alberta Environmental Protection. Its mandate includes an evaluation of the adequacy of the mitigation and monitoring programs.

2.0 MITIGATION PROGRAM DEVELOPMENT

Environmental assessment of the impacts of the ORD project on wildlife began in 1974 with a report by Vriend and Clark (1975). They undertook basin-wide studies to inventory wildlife populations, map vegetation communities, determine critical habitat areas, and determine areas where wildlife habitat conflicts with recreation development. Angus and Keith combined their work with other reports to produce a report titled *Environmental Evaluation, Oldman River Basin Study (1975).*

Between 1976 and 1978, Lombard North Group and The Sibbald Group (1978) undertook Phase II studies to fill data gaps that had been determined during the Phase I studies in 1974. Assessments of alternative dam sites were made on the basis of literature reviews and limited field work. Field work was undertaken to determine population levels of major species in the area of each dam site. The scope of this work was limited to a single season of field investigations. This resulted in a "snapshot" of population levels. While it did provide sufficient information to compare the environmental impacts of the three dam sites being considered, it did not provide enough information to quantify the environmental impacts of the selected project, nor to design a mitigation program.

After the site for the Oldman River Dam was selected in August 1984, detailed environmental studies were undertaken to quantify the impacts and develop a wildlife mitigation program. Results from the following studies were the basis for the development of the program:

- Westworth (1985) prepared an overview of the wildlife resources of the area. The executive summary of this report appears in Appendix C.
- EMA and Salix (1986) and Salix (1986) undertook inventories to establish baseline ungulate populations of the area.
- Reid and Thompson (1985) and Hardy (1986) undertook vegetation surveys of the proposed reservoir area, established a complete list of plant species and recommended reclamation methods.
- Delta (1987) proposed a list of potential mitigative actions to provide compensatory habitat.
- EMA (1988) provided a monitoring program for nesting raptors within the reservoir area.
- Delta (1988) presented options to mitigate project impacts on wildlife other than raptors.
- Delta (1989) presented a strategy that would mitigate project impacts on all wildlife.
- Rood and Mahoney (1991) and Mahoney and Rood (1993) evaluated reservoir impacts on downstream cottonwoods.

The Minister of Environment established a Local Advisory Committee to review the implementation of the ORD project. The Local Advisory Committee established a subcommittee to deal with fish and wildlife issues. This subcommittee, and ultimately the Local Advisory Committee provided significant direction to the mitigation planning process.

The Wildlife Habitat Mitigation Program focused in three main areas;

- Reduce direct impacts of construction and operation of the reservoir on wildlife.
- Develop alternative habitat for the main species that were affected by construction and operation of the dam.
- Collect the baseline monitoring information necessary for long-term monitoring of the resource.

To reduce direct impacts, a wildlife rescue plan was developed to monitor wildlife population response during initial reservoir filling and rescue any individuals in danger. Measures were implemented to provide mule deer safer road crossings. Wildlife Control Areas were designated on the reservoir to protect raptor nests from boating traffic during the critical incubation and rearing stages. A brochure was developed to inform the public about suitable ways of interacting with wildlife species in the vicinity of the reservoir.

To collect baseline information, a monitoring program was developed to allow AEP to assess the impact of the reservoir on wildlife habitat and populations. Habitat Suitability Index models were developed for mule deer, jackrabbits, mallards and sharp-tailed grouse. Habitat and population surveys were conducted to determine baseline conditions.

To develop alternative habitat, grassland and shrub habitat were purchased and enhanced for mule deer, songbirds, and small mammals. Artificial nesting habitat was specifically provided for prairie falcons, Ferruginous hawks, American kestrels, western mountain bluebirds, and waterfowl.

Delta Environmental Group Ltd. and APWSS designed the habitat component of the mitigation program in 1989. Delta (1988) established a variety of habitat improvement options for lands around the Oldman River Dam reservoir from which PWSS selected the projects for the program.

The objective of Delta Environmental Group Ltd.'s design was to replace shrub and tree habitat suitable for mule deer that was lost due to construction and operation of the project. Mule Deer is a species that represent the habitat requirements of species that depend upon riparian forest cover. This habitat type was considered the most important habitat type in the reservoir.

Delta Environmental Group Ltd. used the U. S. Fish and Wildlife's Habitat Evaluation Procedure to quantify the impacts on mule deer habitat. This model served as the basis for selecting projects for the program. Cost-effective projects, those with minimum cost/Habitat Unit (HU) for mule deer, were selected to compensate for the HUs lost[3] to construction and operation of the reservoir.

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[3] Cover and food/ cover habitat units as defined by the mule deer Habitat Suitability Index model.

Delta Environmental Group Ltd. selected tree and shrub planting locations on the basis of topography and exposure and selected tree and shrub planting mixes to match native riparian and shaded vegetative communities. Delta Environmental Group Ltd. selected wetland locations on the basis of topography and availability of natural runoff. Where natural runoff was not available, alternative methods to supply water were considered.

APWSS (1995) shows the tree and shrub planting plans and wetland designs. That report examines the study area quarter-section by quarter-section. Delta Environmental Group Ltd. prepared the plans titled "Planting Design". A plan is provided for each quarter-section of the mitigation land base. Wetland locations are shown on each plan. APWSS prepared the detailed design for each wetland that is shown on a separate drawing in the corresponding section of the report.

Wetlands were included in the program to provide water sources for watering trees and shrubs, to provide riparian edges for riparian vegetation communities, and to provide rearing areas for waterfowl.

Richard Fyfe (Fyfe 1990a) designed the raptor nesting component and part of the waterfowl nesting component of the mitigation program. This design provided alternative nesting sites for the major raptor and selected waterfowl species found in the vicinity of the Oldman River Dam reservoir.

On January 25, 1989, the Alberta Government released a *Strategy* (Delta 1988) that outlined options to mitigate the impacts of the project on wildlife and vegetation resources and an *Action Plan* (APWSS and Delta 1989) that detailed specific mitigation projects that APWSS would implement (news release in Appendix C).

3.0 PROGRAM IMPLEMENTATION

This section summarizes the projects that were implemented to meet the objectives of the program. A discussion of changes that were made from the original program design is also included.

Record Drawings of the program as implemented are shown in APWSS (1995). Detailed field records are shown in APWSS (1994).

3.1 Program Management

APWSS was responsible for overall project management. A. Nilson was the project manager for the Wildlife Habitat Mitigation Program from 1987 until turnover in 1992.

The Fish and Wildlife sub-committee of the Local Advisory Committee reviewed and approved various components of the program. D. Olsen was the chairman of the Fish and Wildlife sub-committee.

Biological consultants were engaged to undertake wildlife population studies, botanical studies, and habitat evaluations. The consultants also developed Habitat Suitability Index models, detailed habitat development plans and supervised construction of the replacement habitat. The following consultants participated in the Wildlife Habitat Mitigation Program.

- D.E. Reid and C. Thompson developed the initial vegetation overview.
- D.A. Westworth and Associates Ltd. developed the initial wildlife overview.
- Hardy Associates (1978) Ltd. undertook the initial vegetation inventory.
- Environmental Management Associates and Salix Enterprises Ltd. undertook population surveys and developed the raptor monitoring program.
- The Delta Environmental Management Group Ltd. (Axys Environmental Consulting Ltd. developed the habitat compensation strategy, Habitat Suitability Index models, and undertook various population surveys.
- R. Fyfe monitored the raptor populations and supervised the development of alternate nesting habitat.
- Wildrose Consulting Inc. monitored vegetation community reestablishment and rare plants.
- Eastern Slopes Rangelands Consultants undertook range condition assessments.
- G. Osterloh monitored shrub regeneration.
- S. Rood and J.M. Mahoney monitored the biology of riparian vegetation communities downstream of the dam and reviewed operational guidelines.
- Tera Environmental Consultants (Alberta) Ltd. monitored the environmental impacts of day to day operations of the contractors.
- J. Carrington and C. Osterloh supervised planting and reclamation.
- D. Hay supervised fencing and nest construction.
- J. Klassen supervised dam and dyke construction.

3.2 Program Costs

Table 1 shows the Wildlife Mitigation Program costs by component from 1987 until 1993.

Table 1 --Oldman River Dam Wildlife Habitat Mitigation Program Expenditures ($1,000)

Component	1987	1988	1989	1990	1991	1992	1993	Total
Program Design	53	78	75	79	53	1		339
Fencing Construction	70	122	163	41	97	72	20	585
Land Assembly	1,100							1,100
Wetland Construction		1	355	378	63	54	3	864
Tree Planting	70	68	89	102	120	17	78	544
Nest Construction		13	49	14	16	1		93
Baseline Monitoring	13	6	30	38	60	146		293
Yearly Total	1,306	288	771	652	409	291	101	3,818

3.3 Direct Impact Mitigation

Although the major wildlife impact of the Oldman River Dam was loss of wildlife habitat, Delta (1992a) also predicted impacts to wildlife populations. These impacts included

- direct flooding mortality from filling the reservoir,
- increased vehicle/wildlife interactions from the new roads,
- increased hunting pressures from improved access and increased local camping opportunities, and
- increased sensory disturbance from mechanical and human sources.

Increased hunting pressure is an operational concern and was not addressed in the mitigation program. APWSS addressed the other three impacts.

3.3.1 Reservoir Clearing

The clearing schedule was altered to maintain the riparian vegetation communities along the Castle River, Crowsnest River, and north stem of the Oldman River for as long as possible. Clearing of the north stem was undertaken during the winter of 1990-91. Clearing of the Crowsnest and Castle rivers was undertaken during the winter of 1989-90. Clearing of the main stem of the Oldman River was undertaken during the winter of 1988-89.

Steep slopes were hand cleared and shrubs less than 3 metres in height were retained to minimize erosion.

Riparian poplar stands that would be flooded by less than 4 metres of water were left in the area where the Castle and Oldman Rivers enter the reservoir. Some species of *populus* can survive long periods of flooding. There were no cottonwoods within 4 metres of full supply level along the Crowsnest River where it enters the reservoir. Stands of balsam poplar were left in the borrow areas that were not flooded by the filling of the reservoir. As far as practical, borrow activities were shifted from the downstream riparian borrow areas to upland borrow sources and sources within the flooded portion of the reservoir to minimize loss of habitat.

3.3.2 Road fencing

Deer fences were installed along the three highway crossings on the reservoir to direct larger mammals to safer crossing locations to minimize vehicle mortality to deer. The fencing was 2.1 m high wildlife wire mesh fence installed on 150 mm diameter pressure-treated wooden posts. Fences were terminated at the top of backslopes for the highway approaches to allow drivers good visibility of deer along the road shoulder.

A path was provided under the end of each bridge that was closest to the shoreline. The other end of each bridge had a long causeway that wildlife would have to traverse to use an underpass. The underpasses had 2 m of clearance and a fine gravel or topsoil surface.

3.3.3 Deer Repellents

A sample of “Wolfin” deer repellents was acquired from a Swedish manufacturer and tested at one road crossing location.

3.3.4 Sensory Disturbance

Construction activities were scheduled to avoid foot traffic within 400 m of the prairie falcon nest locations during the nesting period.

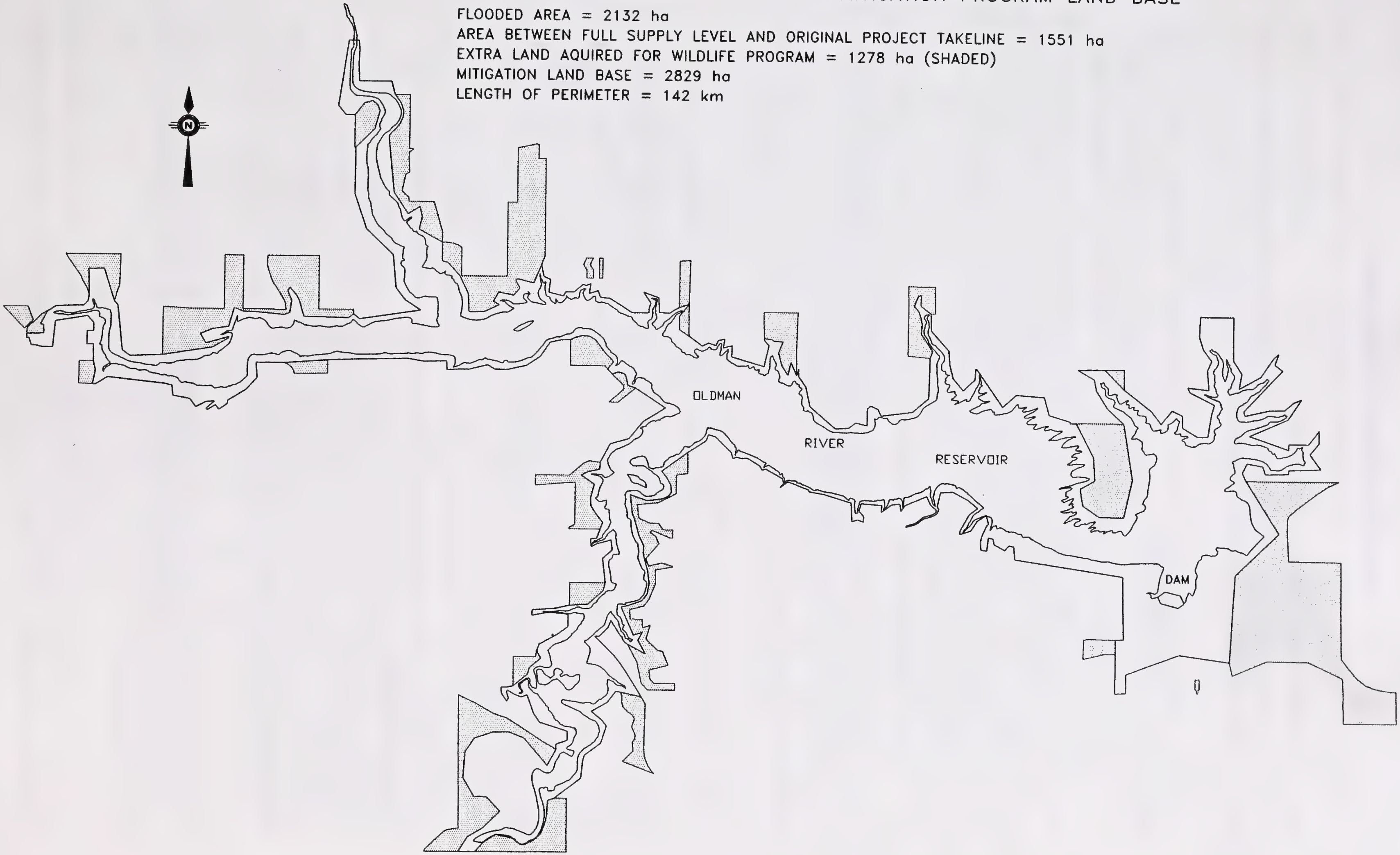
3.3.5 Reservoir Filling Rescue Operation

A program was implemented in 1991 to monitor the direct impacts of filling on wildlife populations. Waterfowl nesting and re-nesting was monitored during filling. Delta (1991) reports on this program and the efforts by waterfowl to re-nest during filling.

Part of this program included the identification of raptors that could be lost to flooding and rescue of these individuals. Raptor eggs and young were moved to appropriate nests to complete their development when flood waters threatened their nests. No attempts were made to salvage waterfowl eggs or small burrowing mammals.

FIGURE 1 – OLDMAN RIVER DAM – MITIGATION PROGRAM LAND BASE

FLOODED AREA = 2132 ha
AREA BETWEEN FULL SUPPLY LEVEL AND ORIGINAL PROJECT TAKELINE = 1551 ha
EXTRA LAND AQUIRED FOR WILDLIFE PROGRAM = 1278 ha (SHADED)
MITIGATION LAND BASE = 2829 ha
LENGTH OF PERIMETER = 142 km



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3.4 Compensatory Habitat Construction

This section describes the construction and planting activities undertaken for the Wildlife Habitat Mitigation Program.

3.4.1 Land Assembly

In many cases, APWSS purchased entire farms for the project, not simply the minimum amount of land required. As a consequence, APWSS acquired about 15,000 ha of land over the amount required for the reservoir and surrounding buffer. Most of this surplus land was cultivated land on the upland plateau; a portion contained native vegetation adjacent to the reservoir lands. APWSS retained 1278 ha of these lands for the Wildlife Habitat Mitigation Program. These lands, along with the buffer for the reservoir, constitute the Mitigation Land Base that is managed for wildlife mitigation purposes (Figure 1).

Table 2 summarizes the composition of lands that form the Wildlife Habitat Mitigation Program land base. The 1991 categorization of the mitigation land base is different from the 1995 categorization because many of the shrub communities were grouped into grassland polygons in the 1991 categorization.

Table 2 --Oldman River Dam Wildlife Habitat Mitigation Program Composition of Flooded and Mitigation Lands

Major Plant Community	Flooded Lands (ha)	Mitigation Land Base (ha)	
	1986[4]	1991[5]	1995[6]
Grasslands	1259	1386	2063
Aspen/ Saskatoon/ Chokecherry/ Juniper	155	843	327
Cottonwoods	313	51	29
Douglas fir, pine	52	51	34
Cultivated lands	347	498	376
Other lands	5	0	
Totals	2132	2829	2829

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[4] Table 1 from Hardy 1986 reduced by 15% to remove buffer lands between full supply level and top of dam.

[5] Based on percentage of total cover type from Table 1 of Eastern Slopes Rangeland Consultants 1992 applied to the total acres from the 1995 HEP model.

[6] 1995 HEP model data.

3.4.2 Fencing

APWSS constructed 142 km of permanent barbed wire fence around the 115 km perimeter of the project and within the project boundary for grazing control. Figure 1 shows the project boundary.

APWSS supplied the materials and hired local contractors to install the fences. Numerous small contracts were issued to apportion the work to smaller contractors and to complete the projects in a timely fashion. Local contractors bid on fencing on a unit (per km) basis.

Fences were constructed with 100 to 150 mm diameter pressure-treated wood posts driven 600 to 750 mm into the ground. The completed fence extended 1350 mm above the ground. Fences were completed with three or four strands of double-strand 12.5 gauge barbed wire. Three stands were used unless land purchase agreements specified four strands. Barbs are spaced at 150 mm intervals. In steep areas that were inaccessible to tractors, hand-driven steel “T” posts were used to support the barbed wire.

Contractors used two methods to install fence posts. The traditional and most popular method in this area uses a hydraulic hammer mounted on a trailer or a front-end loader. The post is driven into the ground by this hammer. One contractor used a vibratory tool to install the posts. This tool was able to install larger posts straighter in harder ground with less damage to the posts than the hammer type.

3.4.3 Wetlands

Sixty-one wetlands were built between June 1987 and August 1992. Local contractors were hired to construct the dams and dykes. The wetland locations and costs are summarized in Table 3. As-built drawings of each wetlands are in APWSS (1995).

Ample quantities of low to medium plastic clay till were available for construction of the embankments. The dams are of homogeneous construction. Broken limestone rip rap was used for erosion protection on most of the dams and spillways. Locally available shale and sandstone were used on two projects.

The rip rap supplier for the main dam contracts developed a quarry 50 km west of the project. APWSS used byproducts from this quarry for the rip rap for the wildlife mitigation program. The rip-rap specification for the wetland dams was angular, well graded limestone, between 100 and 500 mm in size. Fifty cubic meters of rip rap were stockpiled at each dam for future maintenance requirements.

The downstream slopes of the dams and dykes were topsoiled and seeded to a native grass cover.

Table 3 –Oldman River Dam Wildlife Habitat Mitigation Program Wetland Summary

Project Number	Location	Year Constructed	Type	Total Cost ($)
C09-C01	NW2-7-1-W5	1989	Dugout	12,118
C11-W01	NE2-7-1-W5	1990	Dyke	49,400
	SW11-7-1-W5	1990	Dyke	23,300
	SW11-7-1-W5	1990	Dyke	49,400
C12-C01	SE12-7-1W5	Existing	Dam	0
C12-C02	SE12-7-1-W5	1989	Dam	3,300
C15-W01	NE11-7-1-W5	1990	Dam	8,713
C15-W02	SE14-7-1-W5	1990	Two dams	12,856
C15-W03	SE14-7-1-W5	1990	Dugout	5,848
C19-C01	SE13-7-1-W5	1989	Dam	13,090
C19-C02	NE13-7-1-W5	1989	Dam	12,288
	NE13-7-1-W5	Existing	Dam	0
C19-W01	SE13-7-1-W5	1990	Dam	15,834
C20-C01	NW13-7-1-W5	1989	Dam	20,335
C20-W01	SW24-7-1-W5	1990	Dyke	30,134
C26-C01	SE24-7-1-W5	1989	Dam	14,834
C26-C02	SE24-7-1-W5	1989	Dam	16,825
C32-C01	NE23-7-1-W5	1990	Dam	18,460
C32-W01	NW24-7-1-W5	1990	Dyke	7,836
CR08-C01	SE36-7-2-W5	1989	Dam	19,270
CR12-C01	NE28-7-1-W5	1989	Dugout	0
CR13-W01	SE31-7-1-W5	1990	Dyke	19,270
CR13-W02	NE30-7-1-W5	1990	Dam	16,024
CR15-W01	NW31-7-1-W5	1991	Dyke	10,696
CR17-C01	SW32-7-1-W5	1989	Dam	24,374
	SW32-7-1-W5	Existing	Dugout	0

Table 3 --Continued

Project Number	Location	Year Constructed	Type	Total Cost ($)
CR25-C01	NE33-7-1-W5	1989	Dam	12,298
CR25-C02	NE33-7-1-W5	1989	Dam	12,298
CR25-C03	NE32-7-1-W5	1989	Dam	12,881
CR25-C04	NE32-7-1-W5	1989	Dam	12,881
CR25-W01	SW33-7-1-W5	1991	Dam	28,200
OC05-C01	SE34-7-30-W4	1989	Dam	20,190
OC05-C02	SE34-7-30-W4	1989	Dam	20,190
OC05-C03	SE34-7-30-W4	1989	Dyke	12,200
OC05-W01	SE34-7-30-W4	1989	Dam	28,180
OC16-C01	NE25-7-1-W5	1990	Dyke	6,443
	NE25-7-1-W5	1989	Dam	28,300
OC16-W01	NE25-7-1-W5	1990	Dyke	9,229
OC17-W01	SW36-7-30-W4	1990	Dam	20,928
OC20-C01	NW36-7-1-W5	1989	Dam	23,733
OC20-C02	NW36-7-1-W5	1989	Dam	11,575
OC21-C01	NE33-7-30-W4	1989	Dam	14,904
OC21-C02	NE33-7-30-W4	1989	Dam	14,904
OC22-W01	NE26-7-30-W4	1990	Dam	16,984
OC26-C01	SW2-8-1-W5	1989	Dam	18,450
OC26-C02	NE2-8-1-W5	1989	Dam	18,450
OC26-C03	SE2-8-1-W5	1989	Dam	18,450
ON02-W01	SW3-8-1-W5	1989	Dyke on fill	23,300
ON04-C01	NW3-8-1-W5	1989	Dyke	43,242
ON04-C02	SW10-8-1-W5	1990	Dyke	12,000
ON04-C03	SW10-8-1-W5	1990	Dam	10,867
ON23-W01	SE34-7-1-W5	1990	Dyke	27,845

Table 3 --Continued

Project Number	Location	Year Constructed	Type	Total Cost ($)
OS13-C01	SE18-7-29-W4	1992	Dyke on fill	32,200
OS13-C02	SW18-7-29-W4	1989	Check dam	0
OS14-C01	NE9-7-29-W4	1986	Dam	8,300
OS17-C01	SW21-7-29-W4	Existing	Slough	0
OS17-C02	SE21-7-29-W4	1988	Dyke and dugout	3,914
OS17-C03	SW21-7-29-W4	Existing	Slough	0
OS17-C04	NW16-7-29-W4	1988	Dyke	3,809
OS40-C01	SE30-7-29-W4	1990	Dyke	8,351
	SE30-7-29-W4	1991	Road fill	4,550
OS42-C01	NW10-7-29-W4	1991	Three dams	0
OS50-W01	NE30-7-29-W4	1990	Dam	34,028
OS51-W01	SE32-7-29-W4	1990	Dam	11,418
OS52-W01	NW28-7-29-W4	1990	Dam	24,047
OS53-W01	NW28-7-29-W4	1990	Dam	15,193
OS54-W01	SE28-7-29-W4	1990	Dam	32,594
OS54-W02	SE28-7-29-W4	1990	Dam	18,719

3.4.4 Tree Planting

Planting details are in APWSS (1994) and APWSS (1995).

Before the mitigation program was designed in 1989, APWSS purchased and planted commercially-available shelterbelt material at two locations; NE16-7-29-W4M (Glass site) and SW11-7-1-W5M (Stevick site). After the mitigation program was designed, APWSS contracted the collection of native seeds and propagules and the growing of native plant material.

Tree planting began in 1987 using northwest poplar, caragana, and Douglas fir seedlings on the Glass site. The Douglas fir were excavated from the reservoir floor. Additional northwest poplar and caragana, and Colorado spruce, willow, dogwood, and rose were planted on the Glass site in 1988. Cultivated areas at the Glass site were seeded in 1987 and again in 1988.

A buried drip irrigation system was installed to irrigate the planted trees. Snow fences were installed on the windward side of the plantings to provide wind protection. A 15 hp pump at the Oldman River downstream of the dam supplies water to the drip irrigation system on the Glass site. A 75 mm PVC line supplies 400 l/min to the site. The water is distributed through a series of electric valves connected to a electro-mechanical timer. The drip system comprises shallow-buried low flow emitters wrapped with fiberglass insulation to prevent root migration into the line.

During 1989, the Alberta Horticultural Centre supplied plants for the Stevick site. These plants were large (2 m high) deciduous stock from seed collected from various locations in Alberta. The species included poplar, willow, chokecherry, buffaloberry and rose. The plants were planted in a riparian area that would have a high water table when the reservoir filled. Water for early establishment was supplied by a small portable irrigation pump and 40 mm polyethylene hose.

In 1989, nurseries were contracted to grow plants from seed collected from the reservoir area. Alberta Nurseries and Seeds Ltd. was contracted to grow Douglas fir, limber pine, saskatoon, chokecherry, and hawthorn from seed. Hillson Nurseries was contracted to grow poplar and willow from cuttings.

In 1991 Alberta Nurseries and Seeds Ltd. was contracted to grow aspen poplar from seed.

From 1990 to 1993 native stock from the above contracts was planted at selected sites around the reservoir. Temporary polyethylene hose, small portable water pumps and low flow emitters or sprinklers were used to provide water to the plantings. “Soaker” hose was tried and found ineffective unless covered with a mulch.

Two hundred and sixty-four thousand (264,000) plants were delivered and planted between 1987 and 1993. Table 4 summarizes the numbers and species of plants that were delivered to the site.

Table 4 --Oldman River Dam Wildlife Habitat Mitigation Program Seedling Schedule

Species	Plants Delivered by July 1993
Douglas fir	40,000
Limber pine	10,000
Colorado spruce	2,000
Aspen poplar	40,000
Other Poplar and Willow	71,000
Saskatoon	20,000
Chokecherry	20,000
Buckbrush	5,000
Rose	5,000
Hawthorn	20,000
Caragana	21,000
Total	264,000

3.4.5 Nest Construction

Table 5 provides a summary of the replacement nest types and locations. Specific locations of these nesting sites are shown in APWSS (1995).

Constructing nesting sites for prairie falcons began in the winter of 1988-89 when fifteen nesting cavities were constructed in cliffs by

- excavating holes in softer shales and glacial tills with air-operated impact drills and chisels, and
- excavating holes in shear faces of hard sandstone with explosive charges in pre-drilled holes.

By the spring of 1990, 32 more nesting cavities were constructed for prairie falcons. These nest sites were constructed by

- enlarging smaller sites by prying rock and removing excess debris,
- partially blocking the front entrance of large holes with mortar and stone, and
- filling in ledges with mortar and stone.

In the spring of 1990, three more nesting cavities were added for prairie falcons.

In 1991, 19 platforms were installed for raptors that build stick-nests. The platforms were installed on top of treated poles that were installed 1.5 m into the ground.

In 1991 and 1992, 53 boxes for wood ducks and 27 boxes for American kestrels were installed on poles and trees. The American kestrel boxes were installed on Douglas Fir trunks located near the Wildlife Habitat Mitigation Program wetlands. The wood duck boxes were installed primarily on large poplar trees around the reservoir.

Table 5 --Oldman River Dam Wildlife Habitat Mitigation Program Replacement Nest Type and Location

Location	Prairie Falcon Cavities	Hawk Platforms	American Kestrel Boxes	Wood Duck Boxes
NE16-7-29-W4				1
SE14-7-29-W4 NW11-7-29-W4 N10-7-29-W4	Territory[7]		5	11
SW14-7-29-W4 SW15-7-29-W4				8
SW21-7-29-W4 N16-7-29-W4				5
NW, SE28-7-29-W4 SE32-7-29-W4 NE30-7-29-W4		2	3	
NE35-7-30-W4		1		
NE26-7-30-W4			1	
SE34-7-30-W4			1	3
NE2-7-1-W5		2		
NE35-7-1-W5		1		
SW32-7-1-W5		1		
NW31-7-1-W5				5
SE31-7-1-W5		3		
NW30-7-1-W5			3	1
NW28-7-1-W5		1		
NE11-7-1-W5			2	1
S13-7-1-W5				4
NW2-7-1-W5 SW11-7-1-W5		4	6	10

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[7] Prairie falcon territories include a number of alternative nest sites. Only one nest site would be occupied at any one time.

Table 5 --Continued

Location	Prairie Falcon Cavities	Hawk Platforms	American Kestrel Boxes	Wood Duck Boxes
SE11-7-1W5	Territory			
SW2-7-1-W5	Territory			
SE35-7-1-W5		3		
SE36-7-2-W5			2	1
SW10-8-1-W5(East)	Territory	1	2	1
SW10-8-1-W5(West)			2	2
SE10-8-1-W5	Territory			
Total	5	18	27	53

3.5 Baseline and Initial Wildlife Response Monitoring

Delta Environmental Group Ltd. developed a monitoring program (Delta 1992a) that includes population surveys, habitat surveys, and habitat suitability index modeling. Appendix C contains the executive summary.

Four habitat suitability index models and one vegetation model were developed for the monitoring program. The habitat suitability index models for mule deer, jack rabbits, sharp-tailed grouse and mallards are in Appendix E. The purpose of these models is to provide an "accounting" system to enable quantification of habitat changes.

Livestock grazing had suppressed many of the native plant species that certain wildlife species rely on in the fescue grassland communities. The Wildlife Habitat Mitigation Program will allow most of the native species to recover. To enable measurement of changes in the vegetative composition of native fescue grassland communities, one additional model was developed. This model is based on the range condition survey methodology outlined in Wroe et al (1988) which measures the composition of grass species. The model is described in Appendix E. Baseline range conditions are described in Eastern Slopes Rangeland Consultants (1992) and location plans are shown in APWSS (1995).

The following reports contain the results of baseline population surveys that were undertaken from 1989 to 1992:

- Fyfe (1989 and 1990) - raptors
- Smreciu (1990) - vegetation
- Delta (1992a) - 1990 waterfowl
- Delta (1992d) - 1990-91 ungulates.
- Delta (1992e) - 1990-91 mule deer browse and pellet groups.
- Delta (1992f) - mule deer capture and radio-collar details.
- Delta (1993) - 1990-92 songbirds.

The following reports contain the baseline habitat data that was used for the habitat suitability models:

- Eastern Slopes Rangeland Consultants (1992) - range condition of the mitigation land base
- Wild Rose Consulting Inc. (1991 and 1992) - vegetation succession plots
- APWSS (1994) - 1991 shrub regeneration survey

The following reports contain the results of wildlife response surveys undertaken during 1991 and 1992 after first filling of the reservoir:

- Delta (1991b) - wildlife responses to the first filling of the reservoir
- Fyfe (1991 and 1992) - information on raptor nesting success the first two years after filling
- Delta (1992b and 1992c) - waterfowl surveys on the reservoir in the second year of filling
- Delta (1992g) - mule deer fawning success the second year after filling

3.6 Deviations from the Design

The Wildlife Habitat Mitigation Program was essentially implemented in accordance with the *Action Plan*. The only notable deviation was with respect to the numbers of trees planted (Table 6).

Initially, species used in the program in 1987 and 1988 were commercially-available cultivars such as caragana, northwest poplar, and Colorado spruce. These species were used because they were hardy and native shrub and tree species were not available. The *Strategy* and *Action Plan* had not been completed, at that time.

Delta Environmental Group Ltd. prepared detailed planting drawings in 1989 (APWSS 1995). In 1989 the *Action Plan* adopted Delta's design and proposed planting***...trembling aspen, chokecherry, saskatoon, hawthorn, limber pine, and Douglas fir...*** and ***...narrow leaf cottonwoods, sandbar willow, red osier dogwood, and white spruce...***Native shrub and tree species were ordered with delivery timelines of two to three years.

APWSS's planting crews revised Delta's design in the field to take better advantage of local topography, existing vegetation and soil conditions. Delta specified snow fences that would not abate the prevailing winds, specified some plantings in heavy stands of competitive grasses and on dry south facing slopes. Soil conditions precluded wetland development in some areas, thereby precluding any plantings that relied upon those wetlands for moisture. Long shelter belts were replaced by short clumps of trees with snow fencing on two sides to reduce wind stress. Plantings were shifted to avoid heavy growths of grasses in deep wind-blown topsoil and clumps of regenerating shrubs.

In September, 1991, Delta revised the required tree and shrub quantities, increasing the numbers of required trees five-fold. This created significant scheduling problems for the program, scheduled for completion in 1992. The lead time for ordering plant material was at least two years. Local aspen poplar could not be ordered because 1989 and 1990 propagation trials on native seed and root cuttings failed. To partially accommodate this change to the program, APWSS accepted aspen poplar seed sourced elsewhere in Alberta and increased production from existing balsam poplar and willow cutting beds. Additional Douglas fir were also ordered. The number of aspen poplar ordered matched the availability of greenhouse space at Alberta Nurseries and Seeds Ltd.

The focus of the program shifted to aspen poplar and Douglas fir in the uplands to complement the naturally recovering shrubs. Delta's design would have resulted in 150.5 ha of planted upland communities and 53.4 ha of planted riparian communities. The regeneration survey showed that 221 ha of chokecherry, saskatoon, wolf willow, and snowberry shrub communities were recovering at densities several magnitudes greater than the density prescribed by Delta. By 1993, 52 ha of trees and shrubs were planted.

The riparian trees and shrubs were ordered from one nursery. That nursery set up cutting beds from native stock. These beds were used to produce the required plants. When the required number of plants changed, production was increased to the capacity of the cutting beds. There was not enough time to set up additional cutting beds.

Table 6 --Oldman River Dam Wildlife Habitat Mitigation Program Summary of Trees and Shrubs Planted

Species	Initial Requirements 1989[8]	Revised Requirements 1991[9]	Planted by July 1993
Douglas fir	8,337	41,687	40,000
Limber Pine			10,000
Colorado Spruce			2,000
Aspen Poplar	31,662	158,312	40,000
Riparian Poplar/ Willow	20,107	110,534	71,000
Total trees	60,000	310,000	163,000
Saskatoon	14,078	70,390	20,000
Chokecherry	9,613	48,063	20,000
Snowberry	4,477	22,385	5,000
Rose	1,907	9,536	5,000
Hawthorn	3,084	15,421	20,000
Total shrubs	33,000	165,000	70,000
Skunkbrush	947	4,736	
Juniper	947	4,736	
Dogwood	2,599	12,995	
Caragana			21,000
Total other shrubs	4,000	22,000	21,000

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[8] September 29, 1989 memo from Delta Environmental Management Group Ltd.
[9] September 10, 1991 memo from Delta Environmental Management Group Ltd.

4.0 EVALUATION OF MITIGATION PROGRAM

The January 1989, news release committed the Government of Alberta to two objectives for the mitigation program:

1. ***To minimize the potential negative impacts of the Oldman River dam project on wildlife species, and***
2. ***To take advantage of mitigation opportunities arising from the development of the dam and reservoir.***

Since neither of these objectives was definitive, the assessment of the success of the program in meeting these two objectives is presented in qualitative terms.

To more specifically determine how well the program met the commitments of the January 1989 news release, it is necessary to examine specific components of the two released reports. In the following section the results of the program are compared to the Constraints and Assumptions from the *Strategy*. Similarly, the projects implemented are compared to the projects specified in the *Action Plan*.

4.1 *Strategy* - Assumptions and Constraints

The following statements from the Assumptions and Constraints section of the *Strategy* were considered in the development of the mitigation program (Delta 1989). The results of the program are compared to each Assumption and Constraint to gauge the completeness of the program.

1. ***Wildlife habitat mitigation was defined as compensation for losses of wildlife habitat that were incurred during the construction of the ORD and subsequent flooding of the reservoir.***

To allow a quantitative assessment of the program's potential to replace lost habitat, habitat losses and predicted gains were quantified using the U.S. Fish and Wildlife's Habitat Evaluation Procedure (HEP). HEP uses analytical models to quantify habitat changes.

A mule deer model (1987 mule deer model) was developed as the basis for this evaluation (Delta 1989). Using the 1987 mule deer model, Delta estimated that 689 HUs of mule deer habitat would be lost as a result of the construction and operation of the ORD. Of these, 445 were food HUs, that Delta did not consider limiting to the mule deer population of the area. The remaining 244 HUs of cover and cover/ food habitat were considered as limiting to the mule deer population and this habitat type was the focus of the mitigation program.

The original predictions of mule deer habitat loss were updated with more refined vegetation information collected during the initial phases of the implementation program (Delta 1991a). On the basis of this revised model, the loss of cover and cover/food habitat for mule deer was increased to 279 HUs.

Using the 1987 mule deer model, Delta predicted that potential habitat gains of 308 HUs of cover and cover/ food habitat could be realized if the projects, as proposed in the *Action Plan* and as detailed in the planting designs (APWSS 1995), were completed.

The 1987 mule deer model was not sensitive enough to properly evaluate the mitigation program. The model did not include young shrub and tree vegetation. The model did not differentiate between various shrub and grass species. The model was too crude to reflect the effects of various grazing management options on vegetation.

Axys Environmental Consulting Ltd. (Axys) upgraded the 1987 mule deer model[10](Axys 1995) using vegetation data collected during the latter stages of the implementation program (referred to as the 1995 mule deer model). Axys also developed models for rabbits, mallard ducks, and sharp-tailed grouse which Delta Environmental Group Ltd. had proposed as additional indicator species for the monitoring program (Delta 1992a).

Table 7 shows the estimated short and long-term habitat changes on the mitigation land base on the basis of the 1987 mule deer model, the 1995 mule deer model, jackrabbit, sharp-tailed grouse and mallard duck models. The assumptions used are summarized in the footnotes and detailed in Appendix E. Two additional long-term scenarios are provided to evaluate the sensitivity of the recommended grazing strategy.

From Table 7, the 1987 mule deer model predicts habitat gains of 164 HUs (59% of the required 279 HUs) if the recommended grazing plan[11] is followed, 2 HUs (1% of the required 279 HUs) if moderate grazing is allowed on the entire land base or 226 HUs (81% of the required HUs) if grazing is not allowed on the land base.

The 1995 mule deer model cannot be used to compare project gains to losses because the vegetation data from the flooded lands is not detailed enough for the 1995 mule deer model to estimate losses. The 1995 mule deer model is more sensitive than the 1987 mule deer model and its main use is to compare future options on the mitigation land base.

The sharp-tailed grouse, mallard duck and jackrabbit models are intended for evaluating the impacts of future operating scenarios. Losses were never predicted with these models and a data base could not be developed once the reservoir had been cleared.

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[10] The old mule deer model was developed with vegetation data from airphoto interpretation. Data collected during ground surveys was added to the old mule deer model. Species specific vegetation data from range condition and detailed regeneration surveys was required for the new mule deer model.

[11] Alberta Public Works, Supply and Services. 1993. *Oldman River Dam, Grazing Management Plan.*

Table 7 --Oldman River Dam Wildlife Habitat Mitigation Program Potential Habitat Gains on Mitigation Land Base

Habitat Model and Sub-model	Habitat Units at Start of Construction (1989)[12] (Baseline)	Habitat Units at End of Construction (1993)[13] (Change from Baseline in Brackets)	Predicted Habitat Units when Vegetation Matures		
			Recommended Grazing[14]	Moderate Grazing[15]	No Grazing[16]
1987 Mule Deer Model					
Food[17]	529	875 (346)	792 (263)	771 (246)	795 (266)
Cover	1	2 (1)	165 (164)	3 (2)	227 (226)
1995 Mule Deer Model					
Food[18]	315	591 (276)	606 (291)	508 (193)	634 (319)
Cover	96	176 (80)	339 (243)	199 (103)	390 (296)
Sharp-tailed Grouse Model					
	20	36 (16)	44 (24)	32 (12)	49 (29)
Mallard Model					
Nesting	38	473 (435)	622 (584)	443 (405)	693 (655)
Jackrabbit Model					
	452	452 (0)	436 (-16)	454 (2)	429 (-23)

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[12] Baseline conditions before any changes in land use. Assumes: vegetation—1990-1992 surveys; grass and forb height—50 mm; grazing—annual use.

[13] Post-construction conditions after filling of reservoir and implementation of PWSS's Grazing Management Plan. Assumes: grass and forb height—150 mm in managed areas, 50 mm in unmanaged areas; Distance to water—200 m in all areas.

[14] Long-term conditions as-built with PWSS's Grazing Management Plan followed. Assumes: planted vegetation survives; grass and forb height in ungrazed areas—300 mm.; rough fescue composition—10 percent; vetches—5 percent; western wheatgrass—10 percent; crested wheatgrass—10 percent; shrubs and trees in grazed areas—50 percent of Hardy density and 100 percent of potential height; shrubs and trees in ungrazed areas—100 percent of Hardy density and 100 percent of potential height; hay and cultivation continues within land base.

[15] Long-term conditions as-built with managed grazing on entire land base. Assumes: planted vegetation does not survive; other conditions same as as-built; hay and cultivation continues within land base.

[16] Long-term conditions with no grazing. Assumes: planted vegetation survives; shrubs and trees—100 percent of Hardy density and height; grasses and forbs—300 mm; hay and cultivation continues within land base.

[17] Food habitat in the 1987 model—grasslands, cultivation and hay land where shrub density of height is below the Hardy density and height.

[18] Food habitat in the 1995 model—project lands that do not contain any new or existing shrubs.

2. ***A suitable land base will be maintained under Crown control for wildlife habitat mitigation purposes.***

   A land base of 2829 ha surrounding the reservoir was acquired and is managed as a Provincial Recreation Area. This land base contains fescue grasslands and the remaining tree and shrub communities in the river valley and coulees adjacent to the reservoir. Table 2 shows the vegetative composition of the lands that were flooded by the reservoir and the vegetative composition of the lands within the land base for the mitigation program.

   Figure 2 shows the portions of the land base that contain areas that have the potential to achieve a mule deer habitat value of greater than 0.8 HUs. A HU of 1.0 is considered optimum habitat. These areas have the potential to be suitable mule deer habitat and are considered core areas in the mitigation program.

3. ***The Government of Alberta is committed to the long-term maintenance and management of the Wildlife Habitat Mitigation Program and its land base.***

   The land base has been fenced to protect the grasslands from unauthorized grazing or trespass. APWSS prepared a grazing management plan and implemented it during 1991 and 1992. This plan is included in Appendix F.

4. ***If construction activities and reservoir operations provide opportunities for wildlife habitat mitigation, practical and cost-effective habitat projects will be considered for design and implementation as these opportunities arise.***

   - The contractor for the new bridge across the north fork of the Oldman River constructed ON02-W01 from excess material excavated from the east approach to this bridge.
   - The Alberta Renewable Energy Program sponsored the installation of six solar-powered pumping systems. These systems help stabilize the water levels in ten wetlands.
   - The contractor for the upgrading of the Highway 3 bridge constructed the dykes for three large wetlands and the islands at project C11-W01 from waste materials from borrow operations for this bridge upgrade. This provided 12 islands in 60 ha of wetlands with stable shorelines.
   - Alberta Horticultural Center supplied 25,000 surplus trees in 1989 and 1990. These were planted in C11.
   - Upland borrow areas were reclaimed with native species to expand the native grassland and upland shrub habitat around the ORD.
   - The abandoned CPR railway right-of-way was acquired and retained to provide wildlife habitat.
   - The dam face was vegetated with native grasses rather than the initially planned cobble cover.
   - The main dam contractor conducted most of his borrow operations in areas that did not contain cottonwood communities that would not be flooded.

5. ***The wildlife habitat mitigation program will benefit a wide diversity of wildlife.***

The following measures were implemented to increase wildlife diversity:

- Fifty-nine wetlands were developed, 5 existing wetlands were enhanced, and 3 existing wetlands were protected for waterfowl, shorebirds, small mammals, amphibians and reptiles.
- Fifty nesting cavities were constructed for prairie falcons in cliffs around the reservoir. These cavities are also being used by Canada geese, great-horned owls, and ravens. Eighteen nesting platforms for red-tailed hawks, ospreys, and Ferruginous hawks were installed around the reservoir. Twenty-seven medium sized nesting boxes for American Kestrels were installed near wetlands around the reservoir. Fifty-three large nesting boxes for wood ducks and goldeneye were installed in riparian forests around and downstream of the project. Small nesting boxes for western bluebird trails were supplied to two landowners. These are shown in Table 4.
- Rock piles for yellow-bellied marmots and other small mammals were constructed along the Castle River.
- Native trees, shrubs, forbs and grasses were used to provide many different natural habitat niches for songbirds and insects.
- The grazing management plan provides more residual cover for insects, songbirds and small mammals that require residual cover.

6. ***Wildlife habitat projects will be well distributed around the reservoir area.***

Figure 1 shows the distribution of the land base around the reservoir. The perimeter lands form an unbroken strip, except for roads, of habitat around the reservoir.

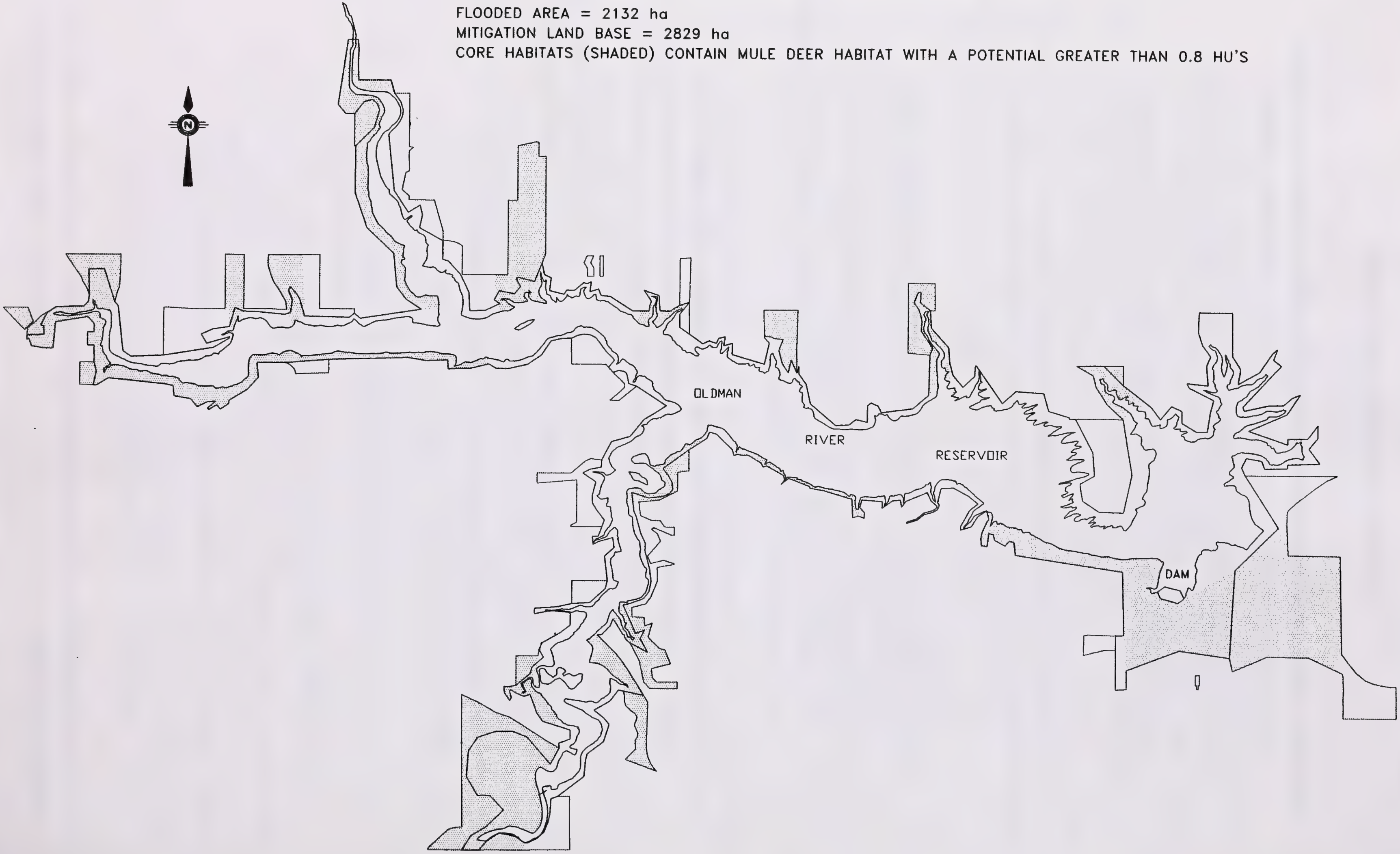
Appendix D shows vegetation mapping for different vegetation communities around the reservoir. Existing and potential shrub habitat is well distributed around the entire perimeter of the reservoir. The north and east facing slopes of the reservoir support natural shrub habitat. This habitat was enhanced by fencing and grazing management. Wetland and shrub establishment efforts were concentrated along the south and west facing slopes where shrub habitat had been sparse.

FIGURE 2 – OLDMAN RIVER DAM – CORE HABITAT AREAS

FLOODED AREA = 2132 ha

MITIGATION LAND BASE = 2829 ha

CORE HABITATS (SHADED) CONTAIN MULE DEER HABITAT WITH A POTENTIAL GREATER THAN 0.8 HU'S



7. ***Wildlife habitat projects will include major blocks of tree and shrub cover (core habitat areas), and movement corridors for wildlife between the core habitat areas.***

   Figure 2 shows the location and distribution of high quality habitat based upon the mule deer model. APWSS (1995) shows the details of fencing and tree planting. Major blocks of tree and shrub cover were preserved and enhanced to maintain and improve escape cover. Smaller areas of enhanced habitat were developed to establish a movement corridor for mule deer through the areas of the reservoir that do not have natural escape cover within 800 metres.

8. ***Wildlife habitat projects will be compatible with existing land uses.***

   A range condition inventory was completed and a range management plan developed (Eastern Slopes 1992). This management plan allows the range condition of the project lands to improve. This is compatible with the agricultural community because grassland in better condition can provide more grazing than grassland in poorer condition.

   Cultivated lands for lure crops have been left at three locations within the land base to reduce migratory bird damage to private crops near the reservoir.

   Maintenance of the land base in permanent grass cover will maintain the project lands in a weed-free condition and reduce damage to adjacent crops from wind-borne soil.

   Wildlife habitat projects were developed to be compatible with future land uses. The Land Use Plan for the M.D. of Pincher Creek was developed to protect primary wildlife habitat by restricting intensive land use. This ensures that intensive development will not reduce the value of wildlife habitat, nor will intensive development create conflicts between adjacent land owners and wildlife.

9. ***In the event that an essential wildlife project is not feasible due to land ownership, incompatible land uses, and/or conflicts with construction activities, alternate habitat opportunities of similar habitat value will be identified and implemented.***

   No projects proposed in the *Action Plan* were not feasible because of incompatible land uses, or construction activities.

   Parts of the S1/2 16, NE 9-29-7-W4 and S1/2 19, SE 24 -30-7-W4 could not be included the land base due to land ownership. Alternate lands in the N1/2 21, SE 18, SE 17-29-7-W4 and SE 12-1-7-W5 were added to the land base as alternate habitat.

10. Downstream wildlife habitat mitigation opportunities will be considered in conjunction with the reservoir operational plan.

One objective of the reservoir operating plan is to provide adequate instream flow downstream of the reservoir to enable regeneration and sustained growth of the cottonwood forests. Healthy cottonwood forests provide prime wildlife habitat.

11. A monitoring program will be implemented to monitor and evaluate wildlife habitat mitigation projects.

A monitoring program was developed by Delta (1992a). Appendix C contains the executive summary of this report. APWSS' responsibility was to complete baseline surveys to enable results of improved land management to be measured in the future to ascertain the effectiveness of the mitigation program.

Section 3.4 contains a list of the monitoring completed up to 1992.

Axys developed four habitat suitability index models to be used in conjunction with the monitoring program. The habitat suitability index models for mule deer, jack rabbits, sharp-tailed grouse and mallard duck are shown in Appendix E. The purpose of these models is to provide a means of quantifying habitat change.

Previous grazing had suppressed or eliminated many of the original plant species in the native fescue grassland community that certain wildlife species rely on. The Wildlife Habitat Mitigation Program allows most of those suppressed plant species to recover. To allow measurement of changes in the vegetative composition of the native fescue grassland community, a vegetation model was developed. The model uses the range condition survey methodology outlined in Wroe et al 1988, described in Appendix E, to measure the composition of grass species. This model is similar to Habitat Suitability Index models. The baseline range conditions are described in Eastern Slopes Rangeland Consultants (1992) and shown in APWSS (1995).

Responsibility for the monitoring program was transferred to AEP in 1992.

4.2 Action Plan - Habitat Mitigation Projects

After a mitigation *Strategy* was outlined in Delta (1989), APWSS (APWSS and Delta 1989) developed an *Action Plan* that detailed specific activities and projects to be implemented. Executive summaries of these two reports are presented in Appendix C. From the *Action Plan* projects fell into three categories:

- ***Habitat protection, which included purchasing private land, fencing to allow controlled grazing, applying vegetation clearing guidelines to retain as much existing habitat as possible, and developing a range management program for lands acquired for the project.***
- ***Habitat enhancement, which included upgrading existing habitat by the installation of snowfence to retain moisture, stabilizing existing wetlands, reseeding cultivated areas to permanent cover, and providing nesting opportunities in existing water bodies.***
- ***Habitat creation, which included impounding of water at approximately 60 locations around the reservoir to provide permanent shorelines for vegetation and water for irrigation of planted vegetation.***

The specific activities and projects proposed in the *Action Plan* are shown below in bold italics followed by the results of the program.

4.2.1 Habitat Protection Measures

The land base acquired for the mitigation program is shown in Figure 1.

1. ***Vegetation clearing guidelines have been established to retain as much habitat as possible. This includes:***

- ***leaving shrubs of less than 3 metres in height within the flood zone of the reservoir:***

All shrubs of less than 3 metres in height were left in the reservoir.

- ***staging the clearing of the reservoir over 1989 and 1990 to delay disturbance of trees and shrubs as long as possible:***

Sequential clearing of the reservoir occurred over three winters.

The Oldman River valley from its confluence with the Castle River to the dam, was cleared in the winter of 1988/89.

The Castle River valley, the Crowsnest River valley, and the Oldman River valley from its confluence with the Castle River to its confluence with the Crowsnest River, were cleared in the winter of 1989/90.

The Oldman River valley north of its confluence with the Crowsnest River, was cleared in the winter of 1990/91.

Filling of the reservoir commenced in April 1991.

- ***minimizing the clearing of Douglas fir and trembling aspen communities in the area between the full supply level and the reservoir takeline:***

Douglas fir stands were cleared to an elevation of 1 metre above the full supply level of the reservoir. Aspen stands were cleared only to full supply level of the reservoir. Detailed survey and flagging of the trees was undertaken to prevent over-clearing.

- ***and preserving stands of flood tolerant trees and shrubs in those areas of the reservoir where shallow flooding of short duration is expected to occur during the normal operation of the reservoir, or where soil erosion will not threaten the moderate to long-term survival of trees and shrubs. This also includes leaving stands of vegetation within the borrow areas downstream of the dam.***

Riparian poplar stands were left in the area where the Castle and Oldman Rivers entered the reservoir to a depth of 4 metres below full supply level. There were no cottonwoods below full supply level along the Crowsnest River where it enters the reservoir. Stands of balsam poplar were left downstream of the dam in the borrow areas. Borrow activities were shifted from the downstream riparian borrow areas to upland borrow sources and sources within the flooded portion of the reservoir.

2. ***All of the land base for wildlife will be fenced to permit management of grazing and other land uses. Fencing costs will be reduced by utilizing 3-wire fence with posts at 5 metre spacing...***

   A three strand barbed-wire fence with posts at 5 metre spacing was used except for areas where arrangements with prior landowners required a four strand fence. Some cross fencing was also included to facilitate grazing management. All of the land base was fenced except for four small areas described below:

   - An area along the new CPR right of way (NE11-7-1-W5M) where other fences already prevent the public and cattle from entering these lands.
   - An area along the Castle River (NW12-7-1-W5M) where the potential habitat gains from fencing are very low, public access is not possible, and the adjacent land is cultivated so cattle use is restricted to fall grazing.
   - An area along the south shore of the main stem of the Oldman River (N19-7-29-W4M) where a fence already exists a short distance back from the reservoir. An agreement is in place to allow for co-managed grazing of the reservoir land base and the private land contained within the existing fence.
   - An area along the south shore of the main stem of the Oldman River (NE23-7-30-W4M) where ground at the fence alignment is too steep to fence. An agreement could not be reached with the adjacent landowner that would allow APWSS to move the fenceline to flatter ground.

A range management program will be developed ...

APWSS developed the range management plan (Appendix E) prior to turnover of the project to Alberta Environmental Protection. The grazing management plan was based upon recommendations from a report by Eastern Slopes Rangeland Consultants (1992). Methods to allow grazing that would not compromise the wildlife and vegetation mitigation objectives were outlined within the plan. Fenced and graveled access was provided to certain wetlands to minimize cattle impacts to the reservoir edge and the adjacent land base.

4.2.2 Habitat Enhancement Measures

1. ***A total of 25 km of snow fence will be installed along the perimeter fence and/or within the land base of 31 projects... Irregular-shaped shelterbelts...will be planted...***

   24.5 km of snow fence were installed along the perimeter fence and within selected projects. Irregular-shaped shelterbelts were planted adjacent to the snow fence within the projects.

2. ***Five existing wetland areas will be enhanced for waterfowl through stabilization of water levels...***

   Water levels in five existing wetlands OS17-C01 (formerly OC26 (2 wetlands)), OS17-C03, and OS40-C01 (2 wetlands) were stabilized with water pumped from the reservoir and Oldman River. Permanent pumps were installed. One of the wetlands at OS40-C01 was enlarged with a small dam. A second area at OS40-C01 was enlarged and flooded to replace the proposed stabilization of water levels at CR14. An island was constructed in one of the wetlands at OS17-C01 and in one of the wetlands in OS40-C01. Shoreline vegetation was planted around all the wetlands. Seeded or native ungrazed upland nesting cover surrounds each of these wetlands. These wetlands are listed as enhanced sloughs on Table 8 and shown on Figure 3 of Appendix D.

   In addition, three existing dams were acquired as part of the land base and enhanced for wildlife habitat through improved range management.

3. ***Nine nesting sites for Canada geese will be constructed on several outcroppings within the reservoir...***

   Nest cribs were constructed on seven islands created when the reservoir filled. Two identified sites were not pursued because they were not isolated by flooding long enough to provide island nesting habitat. However, islands were also created in six wetlands for nesting waterfowl. In addition, Canada geese are using cavities constructed for prairie falcon nesting.

4. ***Native and improved range in several areas within the takeline is in poor condition or has been removed by cultivation. These areas will be reseeded... Some pasture areas will be fertilized...***

   Areas of native rangeland within the mitigation land base recovered well without fertilization because of the wet summers during 1990 and 1991. However, a few areas were over-seeded with a range drill. Weed invasion on native and improved range has been a problem.

   Most of the cultivated areas within the mitigation land base were seeded to forage crops. Borrow areas and the dam face were seeded to native grasses. Several cultivated areas within the takeline were left under cultivation to provide lure crops. Smreciu and Yakimchuk (1994) provide details of reclamation activities and early results.

4.2.3 New Habitat Creation

1. ***New habitat projects will include...The accumulation and storage of water in (behind) check dams, dugouts and newly-created wetlands, and the distribution of water in areas where soil moisture conditions may be presently limiting the establishment of dense tree and shrub cover.....Thirty One check dams and dugouts are proposed.***

   Thirty-eight check dams and dugouts were constructed to hold water for tree plantings and to provide wetland habitat. These are listed as check dams, dugouts and settling ponds in Table 8 and shown on Figure 3 of Appendix D. Detailed drawings of the check dams are shown in APWSS (1995).

   Solar powered water pumping systems were installed at two locations to augment runoff into two check dams. Water levels in four of these wetlands is maintained by electric pumping. Snow fencing was installed to augment runoff at many of the sites.

   Of the 32 check dams and dugouts that are not augmented by pumped water, 25 are operating as intended. Two dugouts do not collect water and 5 check dams function as intermittent wetlands but do not collect or hold enough water to function as reliable tree-watering sources.

   Irrigation systems were installed downstream of many of these wetlands. Trees and shrubs were planted around and downstream of the wetlands. The location of tree and shrub plantings is shown in APWSS (1995).

2. ***New riparian habitat will be provided through the construction of terraces and/or dikes within the upper flood zone of the reservoir. Riparian wetlands will be constructed at 23 locations...***

   Twenty-five riparian wetlands were constructed along the shoreline of the reservoir to provide stable shorelines along the edge of the reservoir. These are listed in Table 8 as riparian dams and riparian dykes and shown on Figure 3 of Appendix D. Detailed drawings of the riparian dykes are shown in APWSS (1995).

   Solar powered water pumping systems were installed at three wetlands to improve the stability of water levels within these wetlands.

   Of the 22 riparian wetlands that are not augmented by pumped water, 18 operate as intended. The remaining four riparian dykes leak.

   Tree and shrubs were planted around the 21 functioning wetlands.

Table 8 --Oldman River Dam Wildlife Habitat Mitigation Program Wetland Summary and Condition

Project Number	Location	Type	Date Completed	Condition 1992
C09-C01	NW2-7-1-W5	Dugout	1989	Leaks
C11-W01	NE2-7-1-W5	Riparian dyke	1990	Normal
	SW11-7-1-W5	Riparian dyke	1990	Normal
	SW11-7-1-W5	Riparian dyke	1990	Normal
C12-C01	SE12-7-1W5	Existing Dam		Normal
C12-C02	SE12-7-1-W5	Check dam	1989	Normal
C15-W01	NE11-7-1-W5	Riparian dam	1990	Normal
C15-W02	SE14-7-1-W5	Riparian dam	1990	Unknown
C15-W03	SE14-7-1-W5	Riparian dam	1990	Leaks
C19-C01	SE13-7-1-W5	Check dam	1989	Normal
C19-C02	NE13-7-1-W5	Check dam	1989	Low runoff
	NE13-7-1-W5	Existing dam		Normal
C19-W01	SE13-7-1-W5	Riparian dam	1990	Normal
C20-C01	NW13-7-1-W5	Check dam	1989	Normal
C20-W01	SW24-7-1-W5	Riparian dyke	1990	Solar pump
C26-C01	SE24-7-1-W5	Check dam	1989	Normal
C26-C02	SE24-7-1-W5	Check dam	1989	Leaks
C32-C01	NE23-7-1-W5	Check dam	1990	Normal
C32-W01	NW24-7-1-W5	Riparian dyke	1990	Solar pump
CR08-C01	SE36-7-2-W5	Check dam	1989	Normal
CR12-C01	NE28-7-1-W5	Dougout	1989	Normal
CR13-W01	SE31-7-1-W5	Riparian dyke	1990	Leaks
CR13-W02	NE30-7-1-W5	Riparian dam	1990	Normal
CR15-W01	NW31-7-1-W5	Riparian dyke	1991	Normal

Table 8 --Continued

Oldman River Dam Wildlife Habitat Mitigation Program
Wetland Summary and Condition

Project Number	Location	Type	Date Completed	Condition
CR17-C01	SW32-7-1-W5	Check dam	1989	Leaks
	SW32-7-1-W5	Existing dam		Normal
CR25-C01	NE33-7-1-W5	Check dam	1989	Low runoff
CR25-C02	NE33-7-1-W5	Check dam	1989	Low runoff
CR25-C03	NE32-7-1-W5	Check dam	1989	Normal
CR25-C04	NE32-7-1-W5	Check dam	1989	Normal
CR25-W01	SW33-7-1-W5	Riparian dam	1991	Normal
OC05-C01	SE34-7-30-W4	Check dam	1989	Normal
OC05-C02	SE34-7-30-W4	Check dam	1989	Normal
OC05-C03	SE34-7-30-W4	Check dam	1989	Normal
OC05-W01	SE34-7-30-W4	Riparian dam	1989	Normal
OC16-C01	NE25-7-1-W5	Dugout	1990	Leaks
	NE25-7-1-W5	Check dam	1989	Normal
OC16-W01	NE25-7-1-W5	Riparian dyke	1990	Leaks
OC17-W01	SW36-7-30-W4	Riparian dam	1990	Normal
OC20-C01	NW36-7-1-W5	Check dam	1989	Normal
OC20-C02	NW36-7-1-W5	Check dam	1989	Normal
OC21-C01	NE33-7-30-W4	Check dam	1989	Normal
OC21-C02	NE33-7-30-W4	Check dam	1989	Normal
OC22-W01	NE26-7-30-W4	Riparian dam	1990	Normal
OC26-C01	SW2-8-1-W5	Check dam	1989	Normal
OC26-C02	NE2-8-1-W5	Check dam	1989	Normal
OC26-C03	SE2-8-1-W5	Check dam	1989	Normal

Table 8 --Continued

Oldman River Dam Wildlife Habitat Mitigation Program
Wetland Summary and Condition

Project Number	Location	Type	Date Completed	Condition
ON02-W01	SW3-8-1-W5	Riparian dyke	1989	Normal
ON04-C01	NW3-8-1-W5	Check dam	1989	Solar Pump
ON04-C02	SW10-8-1-W5	Check dam	1990	Solar pump
ON04-C03	SW10-8-1-W5	Check dam	1990	Normal
ON23-W01	SE34-7-1-W5	Riparian dyke	1990	Solar pump
OS13-C01	SE18-7-29-W4	Check dam	1991	Leaks
OS13-C02	SW18-7-29-W4	Check dam	1989	Normal
OS14-C01	NE9-7-29-W4	Check dam	1988	Normal
OS17-C01	SW21-7-29-W4	Enhanced	Slough	Electric pump
	SW21-7-29-W4	Enhanced	Slough	Electric pump
OS17-C02	SE21-7-29-W4	Check dam	1988	Electric pump
OS17-C03	SW21-7-29-W4	Enhanced	Slough	Electric pump
OS17-C04	NW16-7-29-W4	Check dam	1988	Electric pump
OS40-C01	SE30-7-29-W4	Check dam	1990	Electric pump
	SE30-7-29-W4	Check dam	1990	Electric pump
OS42-C01	NW10-7-29-W4	Settling ponds	1991	Normal
OS50-W01	NE30-7-29-W4	Riparian dam	1990	Normal
OS51-W01	SE32-7-29-W4	Riparian dam	1990	Normal
OS52-W01	NW28-7-29-W4	Riparian dam	1990	Normal
OS53-W01	NW28-7-29-W4	Riparian dam	1990	Normal
OS54-W01	SE28-7-29-W4	Riparian dam	1990	Normal
OS54-W02	SE28-7-29-W4	Riparian dam	1990	Normal

3. ***New nesting cavities for prairie falcons and ferruginous hawks will be constructed on cliffs above full supply level of the reservoir or on cliffs adjacent to the reservoir edge...***

   50 nesting cavities were constructed in cliffs in existing territories and in five new territories around the reservoir for prairie falcons. Canada geese, great-horned owls, and ravens also use the nesting cavities.

   18 nesting platforms were installed around the reservoir for ferruginous hawks. Red-tailed hawks and osprey also use these platforms.

   Table 2 shows the locations of the new prairie falcon territories, hawk nesting platforms and American kestrel and wood duck boxes. Fyfe (1990a, 1990b, 1991, and 1992) describes the raptor nest construction and monitoring program.

4. ***On the request of the local wildlife advisory sub-committee, two marmot colonies that are presently located in the reservoir area will be transplanted to new locations above full supply level....***

   The marmots did not use the rock piles constructed along the Castle River.

4.3 Initial Wildlife Response

The first goal of the mitigation program was ***...to minimize the potential negative impacts of the Oldman River dam project on wildlife species***. The potential of the mitigation program to provide adequate habitat to meet this objective in the long-term is evaluated in preceding sections 4.1 and 4.2.

In this section, the initial population survey data for mule deer, prairie falcons, ferruginous hawks, waterfowl, and songbirds are presented as an indication whether the construction and filling of the reservoir had an immediate negative impact on wildlife populations.

1. Mule Deer

Table 9 shows the mule deer response at the reservoir from 1985 until 1994 and in the check-blocks[19] from 1978 to 1994.

Table 9 --Oldman River Dam Wildlife Habitat Mitigation Program
Mule Deer Populations

Location	1978	1980	1985	1986	1990	1991	1993	1994
Reservoir Area[20]			340	390	550	550	690	740
Regional Check-Blocks[21]	1150	620	1050		450	700	250	170

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[19] Check-blocks are blocks of nearby habitat away from the reservoir that have been surveyed regularly by Alberta Fish and Wildlife to determine regional trends in ungulate populations. Nine blocks surrounding the reservoir were selected in 1990 (Delta 1992e) to serve as checks for the ORD population.

[20] Axys 1994a. Number of mule deer

[21] Axys 1994a. Density of mule deer/ 100km^2

Table 10 --Oldman River Dam Wildlife Habitat Mitigation Program
Prairie Falcon Nesting Summary

Year	Cumulative Nesting Cavities Constructed by the Mitigation Program	Nests Occupied by Prairie Falcons in the Study Area	Mitigation Program Cavities Utilized by Prairie Falcons
1968		4	
1969		5	
1970		3	
1971		4	
1972		2	
1973		4	
1974		5	
1975		5	
1976		5	
1977		6	
1978		6	
1980		4	
1985		8	
1986		5?	
1987		4?	
1989	15	15	1
1990	47	13	3
1991	50	13	4
1992	50	12	3
1993	51	10	5

2. Birds

Four prairie falcon nesting sites were flooded or disturbed by the construction of the reservoir. Impacts on prairie falcon was measured by the number of occupied nesting sites lost in the vicinity of the project. Other measures of impacts on prairie falcons such as the number of fledglings per nest are available in Fyfe (1990a, 1990b, 1991 and 1992). Table 10 shows a summary of natural and constructed nest hole use from 1968 until 1993 (Fyfe 1993). The data from 1968 to 1987 are from previous work by the Canadian Wildlife Service.

All active ferruginous hawk nests were outside of the construction and flooding zone. None were lost due to construction and flooding of the reservoir. Eighteen nesting platforms were installed around the reservoir for use by large raptors such as the ferruginous hawk. The existing and new nests were monitored and documented in Fyfe (1993). In 1994 all inventoried existing ferruginous hawk nests and one platform were used by ferruginous hawks.

Table 11 shows waterfowl data from waterfowl surveys that were conducted by Delta in 1990 before filling, 1991 during filling and 1992 after filling of the reservoir.

Songbird surveys were conducted during filling from 1990 to 1992 (Delta 1993). The area available for these songbirds was reduced from 4961 ha in 1990 to 2829 ha in 1992 when the reservoir was filled. The number of species along the transects of the survey varied from 44 to 45 species. From 1991 to 1992 the density of birds increased from 31/ km to 64/ km of transect.

Fyfe also recorded the total number of species of birds in his reports (Fyfe, all). Fyfe recorded 91 species in 1989, 106 species in 1991, 115 species in 1992 and 117 species in 1993. This included waterfowl, songbirds and raptors.

Table 11 --Oldman River Dam Wildlife Habitat Mitigation Program Summary of Waterfowl Surveys (Delta 1992b,c,d)

	June Survey[22]			October Survey[23]	
	1990	1991[24]	1992	1990	1992
Geese	229	142	278	14	768
Ducks	97	466	581	263	1544
Colonial	2	26	18	2	423[25]

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[22] May 29 to 31, 1990 and June 8 to 11, 1992.

[23] October 15 and 16, 1990 and October 6 to 9, 1992.

[24] Survey June 4 to 7, 1991. Reservoir filled to 1110 m, 8.6 m below full supply level.

[25] 419 grebes

4.4 Evaluation of Techniques

A number of techniques were used to develop the Wildlife Habitat Mitigation Program. These techniques were recommended by consultants or developed from APWSS experience. These techniques were based upon animal behavior, land values, construction costs and reclamation technology. The short-term effectiveness of each technique is evaluated in this section as far as possible. The long-term benefits of each technique can only be evaluated in the future after the projects mature. Alberta Environmental Protection is evaluating these techniques as part of the monitoring program. The techniques used are listed below:

1. Enhancing lands adjacent to the reservoir to provide all required habitat.
2. Reclaiming disturbed areas to produce native grass.
3. Installing three-wire fences to control cattle.
4. Installing snow fences to encourage shrub development.
5. Installing deer fences to reduce crossing mortality at bridge locations.
6. Constructing low cost dams to create wetlands in coulees.
7. Constructing wetlands on reservoir terraces to provide stable shoreline habitat.
8. Planting native trees and shrubs to provide habitat.
9. Irrigating and mulching around trees planted directly into grassland to compensate for drought stress.
10. Installing nest poles and cavities to create raptor nesting opportunities.
11. Installing rock piles to create marmot habitat.
12. Using one HSI model to determine compensatory habitat.

1. Enhancing lands adjacent to the reservoir to provide all required habitat.

Enhancing the carrying capacity of existing lands for mule deer was less expensive than acquiring and protecting additional grasslands around the reservoir but more expensive than acquiring and protecting riparian lands away from the reservoir. The following analysis was based upon predicted habitat value and actual cost. Actual habitat value may differ.

Delta (1987), estimated the costs for a variety of options for habitat enhancement and the associated habitat benefits. The options identified in that report could have produced 1024 habitat units[26] (HUs) of mule deer food/cover habitat by a combination of protection and enhancement projects. The average cost of producing habitat estimated in that report was $4,860/ HU. Protection projects ranged in cost from $1,000/HU on crown land to $13,000/HU on private land. Enhancement projects ranged in cost from $10,000/HU to $30,000/HU.

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[26] A habitat unit is a unit of measurement defined by the Habitat Evaluation Procedure produced by U.S. Fish & Wildlife Service. See Delta 1987 for a description of the procedure.

One of the requirements of the Wildlife Habitat Mitigation Program was that it provide a continuous corridor for mule deer movement around the reservoir. Based on these cost estimates and this constraint, the Government of Alberta chose to enhance lands that were required for the reservoir and to purchase additional lands adjacent to the reservoir rather than purchase additional lands removed from the reservoir.

There were 1551 ha of land purchased as a buffer around the reservoir for shoreline erosion and operator access. The first approach used was to protect that land base for wildlife. The fencing and removal of grazing of these 1551 ha created about 66 HU of mule deer habitat at an average cost of $8,900/ HU. Table 12 summarizes the major approaches used to provide the habitat to compensate for lost habitat.

The second approach used was to acquire available native grassland adjacent to the reservoir related land base. An additional 1278 ha was acquired for the wildlife and recreation programs. This additional land increased the amount of fencing required to enclose the entire land base by 27 km. This additional land base is predicted to provide 53 HUs of mule deer habitat at an average cost of $19,800/ HU.

The third approach was to increase the habitat value of the land base by the addition of wetlands and tree planting. An additional 189 HUs are predicted to be produced upon maturity at an average cost of $7,900/ HU.

An alternate approach might have been to acquire a larger land base along the rivers upstream and downstream of the reservoir and allow the compensatory habitat to recover without any enhancement measures other than a change of management practices. Downstream habitat has a higher potential habitat gain for mule deer than the grasslands around the reservoir. The average gain from protection efforts on grassland is 0.04 HU/ ha[27]. The riparian forest downstream has a potential gain of 0.25 HU/ ha. Producing habitat by acquiring and protecting downstream riparian forest might have been accomplished for about $4000/ HU[28].

This analysis would produce different results for other species. Impacts on species dependent upon grass, such a Baird sparrow, may be better mitigated by the purchase of grasslands rather than downstream riparian forests. A number of species must be considered before accepting a particular approach.

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[27] 53 HU/ 1278 ha = 0.04 HU/ha and 66 HU/ 1551 ha = 0.04 HU/ha

[28] land and fencing cost - $1000/ha

Table 12 --Oldman River Dam Wildlife Habitat Mitigation Program Summary of Unit Costs of Producing Mule Deer Habitat

Approach	Predicted Mule Deer Habitat Benefit[29]	Actual Cost	Unit Cost
Protect initial land base	66 HUs[30]	$585,000[31]	$8,900/HU
Purchase and protect additional grasslands adjacent to reservoir	53 HUs	$1,050,000[32]	$19,800/HU
Enhance existing land base	189 HUs	$1,501,000[33]	$7,900/HU
Purchase and protect downstream habitat		not used	$4,000/HU

2. **Reclaiming disturbed areas to produce native grass.**

Several areas disturbed by project construction were reclaimed with native grass species. Other locations were reclaimed with traditional agronomic species. Reclamation locations are detailed in APWSS (1995).

Disturbed sites with existing topsoil or stockpiled topsoil were seeded with agronomic mixes of commercially-available native grass seed. Long-term monitoring is required to determine the success of the seed mixes used and the succession to native grasses.

The dam face was covered with freshly-removed topsoil from the reservoir. It was spread within hours of being loaded and seeded with a short lived cover crop of oats and non-aggressive short-lived wheatgrasses. The use of fresh topsoil ensured that viable seeds and rhizomes were not killed by storage. The site was mulched and crimped with oat straw. (Smreciu and Yakimchuk 1995). Early results indicate that the number of native species on this site is higher than on sites that used cultivated soils.

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[29] Habitat value for mule deer for cover and food/cover needs only (food HUs ignored) from Delta Environmental Management Ltd. (August 20, 1990 letter).

[30] 119HU x 1551ha/2829ha

[31] Actual cost of fencing

[32] Cost of additional land plus fencing = (1,278 ha land x $750/ha) + (27km x $3,500/km)

[33] Actual cost of wetlands and tree planting projects

Reclamation of cultivated sites to hay crops was an effective way to cover soil and control weeds. The hay crops are of value to wildlife. Alfalfa and sweet clover worked well on weedy sites. The climax ground cover sought on the land base is a self-sustaining native cover; however, it is doubtful that a homogeneous crop of agronomic grasses and legumes will evolve to a native community. The homogeneous crop requires monitoring to see if a permanent native cover will eventually replace the hay crop or if native grasses will have to be over-seeded.

Roadsides were seeded with a mix of agronomic legumes and grasses. The seed mix worked well where slopes were flatter and ample topsoil was applied. A suitable ground cover did not establish in steeper areas and the areas required reseeding. The legumes and nurse crop attracted mule deer and may have caused deer losses from vehicle collisions during the initial years of establishment.

3. Installing three-wire fences to control cattle.

A three-strand barbed wire fence on wooden posts was effective at controlling cattle while allowing unrestricted wildlife movement.

In future, were practicable, enough land should be purchased to allow fences to be placed on ground that is not steeply undulating. Fencing on the property boundary where it traversed steep, rocky and undulating ground requires greater maintenance than fencing on flatter areas and restricts access for shoreline maintenance. To reduce maintenance costs and improve access, some fencing was installed outside the property boundary with adjacent landowner agreement.

4. Installing snow fences to encourage shrub development.

Long-term monitoring of test sites is necessary to determine if shrubs benefited from snowfencing. Snow fencing was used to increase available soil moisture for shrubs and to reduce wind stress. Soil moisture does increase behind the snow fences (Wild Rose 1992). However, to date, results do not confirm that shrubs substantially benefited from this increased moisture. Weeds and agronomic grasses may have benefited more from the snowfences to the detriment of shrubs.

Snowfences should touch the ground to reduce wire stretching. Snow fencing was fastened to portions of the barbed wire fences. Initially, the bottom of the snowfence was placed 150 mm off the ground to allow wind to blow beneath the fence and create a longer, flatter snow drift that would not crush the plants. However this technique resulted in stretched barbed-wire when snow accumulated.

Snowfencing does not need to be painted. The snow fences were made of a 1.2m by 40mm by 10mm wood slat fence at 40mm spacing. Initially, this material was stained with a red oxide primer. Subsequent fencing material was ordered without the primer. This allowed it to blend into the landscape better and reduced costs. The unprimed fence performed as well as the primed fence during the plant establishment period.

5. Installing deer fences to reduce crossing mortality at bridge locations.

Wildlife fencing worked well at directing deer to safer crossing locations along roadways around the reservoir. Deer used pathways that were provided under one abutment for each reservoir bridge crossing. Deer initially had problems crossing the roads. Some deer became trapped between the wildlife fences. Sharp corners in the fence seemed to accentuate the problem by trapping deer. The grass cover between the fences was part of the cause of deer being trapped between the fences. The species planted to reclaim the roadside were lush and attractive to deer. Once deer became accustomed to the wildlife fence and the initial growth of lush grasses subsided, deer mortality due to vehicle collisions decreased markedly.

6. Constructing low cost dams to create wetlands in coulees.

Low cost dams created good wetlands. Many small dams were constructed above full supply level and along the edge of the reservoir to create wetlands. Most of these were relatively inexpensive to construct and are working well. Water levels are stable in most of these wetlands and vegetation is becoming established around the perimeter. The dams that were constructed in coulees with medium volumes of water runoff and thick till deposits are performing the best.

7. Constructing wetlands on reservoir terraces to provide stable shoreline habitat.

The wetlands constructed on terraces just below full supply level drain too quickly to be effective. Many wetlands constructed on terraces just below full supply level of the reservoir failed to hold water long enough to establish shoreline vegetation because of the porosity of the silt, sand, and gravel materials in these terraces. They were generally more expensive to build than the smaller dams in coulees but were expected to provide more benefits than the check dams because of their larger size and more dependable water supply. Solar pumping systems that were installed to supply water before the reservoir was initially filled could not provide enough water to stabilize levels in these wetlands. Sealing these structures to allow them to function as intended would be costly. These wetlands may seal over time and provide wetland benefits. They should be monitored but not decommissioned.

Several existing sloughs and wetlands were refilled and water levels stabilized by pumping. Very small amounts of water were required to maintain a stable water level and a healthy vegetation community.

If erosion protection is not readily available, wetland construction may not be an appropriate technique. Adequate slope protection is necessary to protect embankments from flash flooding and wave action. This is very expensive if rip rap has to be hauled a long distance.

8. Planting native trees and shrubs to provide habitat.

Native trees and shrubs were successfully propagated commercially by nurseries.

Initial tree planting efforts involved only commercially-available cultivars of trees and shrubs because of their availability. Of those purchased, the only trees and shrubs that did well were caragana and Colorado spruce. These are not native species and provide limited benefit for wildlife. After 1989, native trees and shrubs were exclusively used for the remainder of the program.

All the shrubs and trees found in the reservoir area that were appropriate for the drier grassland environment were selected for propagation. Local seed collected from limber pine and aspen poplar was not viable during the two years it was collected. Both species were at the limits of their ranges and did not have the conditions necessary for viable seed production during the years seed was collected. Limber pine seed that was used came from about 100 km northwest of the project. Aspen poplar seed came from about 500 km north of the site. Seed for the other shrubs and trees was successfully collected and propagated from local stock found in and around the reservoir.

Various sizes of containers were used for seedlings. Trees and shrubs in 4 litre pots established better; smaller containers required more maintenance. Two year old plants survived much better than younger seedlings or older stock.

9. Irrigating and mulching around trees planted directly into grassland to compensate for drought stress.

It is too early to determine if the few years of irrigation applied to seedlings helps to permanently establish these seedlings.

Temporary surface irrigation systems were more cost-effective than trucking water or installing permanent irrigation systems to establish seedlings. Irrigation systems were used to help establish the tree and shrub seedlings. A permanent underground system was installed at one planting site. Temporary surface systems were installed at other sites. The temporary systems were less expensive and worked well. The temporary systems were connected to small portable gasoline-powered pumps that were rotated among sites. Water was pumped up to 4 km with larger permanent pumps. The piping was left at each site. PVC was used for the buried systems because of its low cost. Polyethylene tubing was used for the surface systems because of its resistance to sunlight and frost damage. Low pressure, drip emitters were used throughout.

Trees and shrubs planted directly in grasslands did not flourish as expected. Weeds and aggressive grasses proved to be strong competitors for planted trees and shrubs. Chemical weed control, although used to establish plants, was not an option for ongoing control because of the vulnerability of planted vegetation. Hand weeding was too expensive. Cultivation in native grasslands was considered counter productive. Both wood-chip and man-made mulches were used to reduce competition for water and sun light. These mulches also help maintenance staff locate the young plants. The wood chip mulch tended to blow away and expose the soil around the plant to erosion. A synthetic weed barrier cut in one metre squares or one metre wide strips and held down with 150mm staples, was effective at controlling grasses.

While some browse was expected, deer and rabbit browse proved to be a very significant impediment to the establishment of new trees and shrubs. The only species not browsed were Colorado spruce, Douglas fir, limber pine, and caragana. Four fenced enclosures were constructed to evaluate the impact of deer browse on trees and shrubs. These require assessment every few years. Monitoring will determine if the aspen poplar growth can overcome the rate of deer browse.

10.Installing nest poles and cavities to create raptor nesting opportunities.

All the nesting facilities constructed for the birds proved successful. The nesting cavities for prairie falcons were readily accepted by falcons as well as Canada geese, and great horned owls. Nesting platforms are being used by red-tailed and ferruginous hawks for nesting and ospreys have shown interest. Nesting boxes for American kestrels and wood ducks are being used by these species.

Natural Douglas fir trunks and treated poles were used to support the platforms and American kestrel nesting boxes. For best results it was found that the poles should be pressure-treated wood and installed to a depth of 1.5 metres.

11.Installing rock piles to create marmot habitat.

The two marmot colonies that were reported along the Castle River did not use the rock piles that were provided for them. One colony disappeared before construction started. The remaining colony was not observed immediately after filling of the reservoir. Individuals have shown up at other locations where large rock was placed during the construction of the project.

12.Using one HSI model to determine compensatory habitat.

The use of one HSI model (mule deer) to measure compensatory habitat governed the types of projects that were undertaken. This led to criticism that the program was not addressing all species, particularly species that inhabit old growth cottonwood forests. The mule deer model did not represent some of these species adequately and some habitats are not provided for in the mitigation program. It would have been better to use HSI models for more than one species to represent the habitat that would to be lost and to measure habitat gains.

5.0 RECOMMENDED MANAGEMENT STRATEGY

1. Grazing Management

The grazing management plan (Appendix E) is based upon the recommended grazing levels in Eastern Slopes Rangelands Consultants (1992). Grazing is recommended for grasslands that show low potential for shrub development. These recommendations allow the range condition of these grasslands to recover, maintain the diversity of vegetative species on these lands, and reduce the risk of fire due to thick stands of dry grass.

Areas with potential for shrub development should not be grazed in the short-term unless fine litter accumulation is severe. These shrubs are critical to provide winter thermal cover for mule deer, nesting opportunities for songbirds, and escape cover for small mammals. Very low grazing rates or complete exclusion would allow these shrubs to recover. The baseline condition of all the shrub communities is shown in APWSS (1995).

Future management should include controlled grazing on grasslands, restricted or no grazing in areas of concentrated shrubs, and ongoing evaluations at 5 year intervals of range condition of the grasslands.

2. Wetlands

The wetlands that are not performing as designed should be monitored to see if their performance improves as runoff and erosion fills the leaks. The potential value of these wetlands should be determined before any repairs are undertaken. The mitigation program may have the potential to produce sufficient habitat without repairing these wetlands or alternatively, by adding less costly habitat improvements.

Sealing wetlands to prevent seepage would be costly but could be considered if the benefits of these wetlands are required to meet the objectives of the program. Improving snow catchment with additional snow fencing around the wetlands in low runoff coulees could also be considered.

3. Tree Plantings

The naturally-regenerating shrubs and the planted trees should be allowed more time to develop before any replacement planting is considered. The viability of planting additional trees and shrubs in a grassland environment needs to be confirmed. The progress of the regenerating shrubs also needs to be confirmed. A more accurate estimate of potential habitat gains could then be made to determine whether there are any shortfalls in the habitat.

The irrigation systems that support the enhanced sloughs at OS17 and OS40 should be maintained. Any trees watered from these systems should continue to be watered. Drip systems from check dams should be operated to support planted riparian vegetation.

4. Monitoring

The program outlined in Delta (1992a) is intended to guide the ORD monitoring program.

In addition to the program outlined in that report recommended monitoring includes:

1. Monitor Habitat Suitability Index variables to verify the Habitat Suitability Index models.
2. Monitor the vegetation recovery plots established by Smreciu (1990) and Wild Rose (1992) on a periodic basis to determine the succession of reclaimed and recovering areas and the effects of snow fencing in these areas.
3. Monitor the vegetation inside and outside the four wildlife enclosures to determine the impact of the animal browse on shrubs and trees.

6.0 ENHANCEMENT OPPORTUNITIES

One tenet of mitigation is to replace habitat that would be lost. The mitigation program turned grassland into forest habitat, wetlands and riparian habitat. During the course of this work many enhancement opportunities were identified. Some were implemented as a consequence of construction.

Development of some of these enhancement opportunities may not support the mitigation objectives. Optimizing wildlife habitat may result in a decrease in mule deer habitat produced by the mitigation program. The specific goals of the mitigation program might have to be altered if such an approach were adopted.

The following opportunities are worthy of consideration during the operation phase of this project:

1. Maximize ground squirrel production

Three species of ground squirrels were found in the Oldman River valley at the project. The ground squirrel is an important food source for most of the carnivores such as coyotes, badgers, and long-tailed weasels and raptors such as prairie falcons, ferruginous hawk, burrowing owl and red-tailed hawks. Ground squirrels were not considered during the development of the mitigation program.

Cultivated lands that are not required for the bait program and tame pasture within the mitigation land base could be re-seeded with native grass species and managed to maximize ground squirrel production.

The developing tree and shrub habitat would be at the expense of grassland habitat. The native grassland habitat may be more important for optimized wildlife diversity. Mowing of some of the regenerating shrubs could be considered to maximize ground squirrel production.

2. Maximize waterfowl, shorebird, colonial bird and fish-eater production

A significant opportunity of the reservoir is the large water surface of the reservoir. This water surface has attracted waterfowl, shorebirds and fish-eating birds. Since these species were not significantly affected by the project, they were not an objective of the mitigation program. Some waterfowl and fish-eater habitat was enhanced through the construction of the wetlands.

The large wetlands could be further enhanced with additional islands. Islands in the reservoir could be enhanced to provide additional nesting sites for waterfowl and colonial birds.

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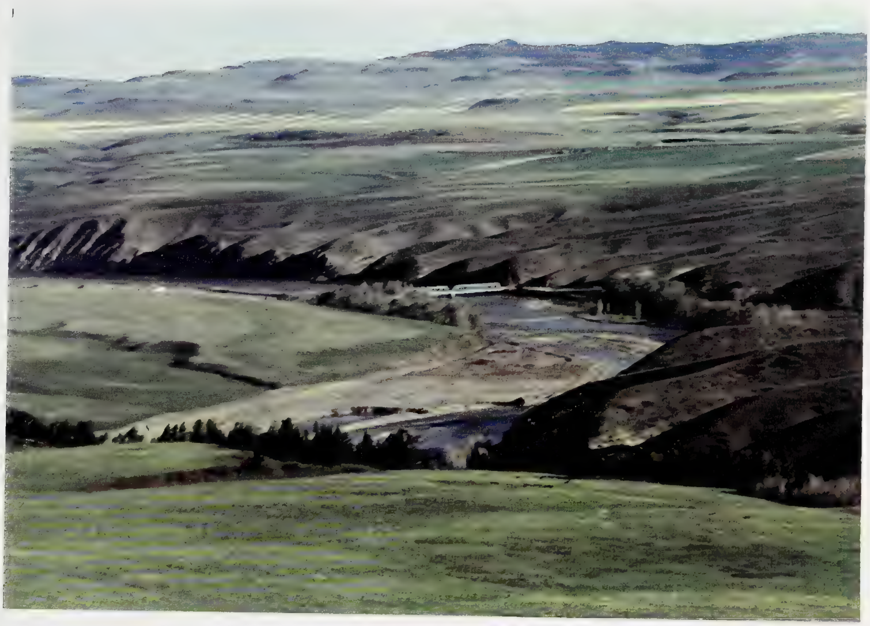
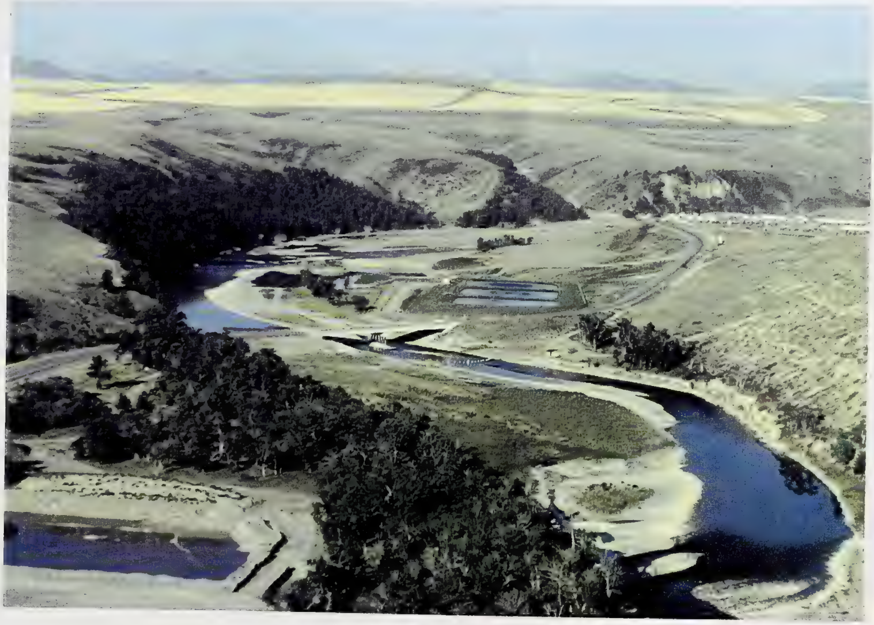
APPENDIX A

PHOTOGRAPHS



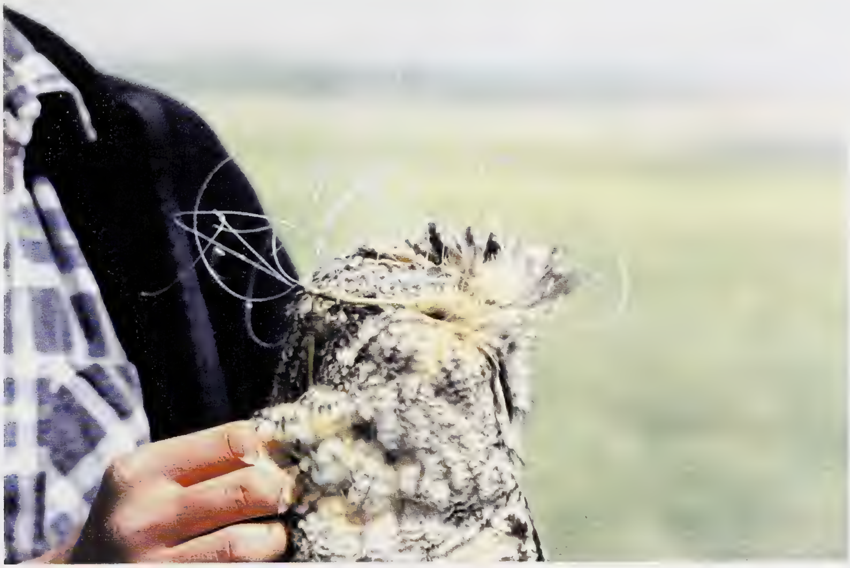
Photograph 1. View of the Oldman River in the Bitango bridge area before filling of the reservoir (4 km upstream of dam.



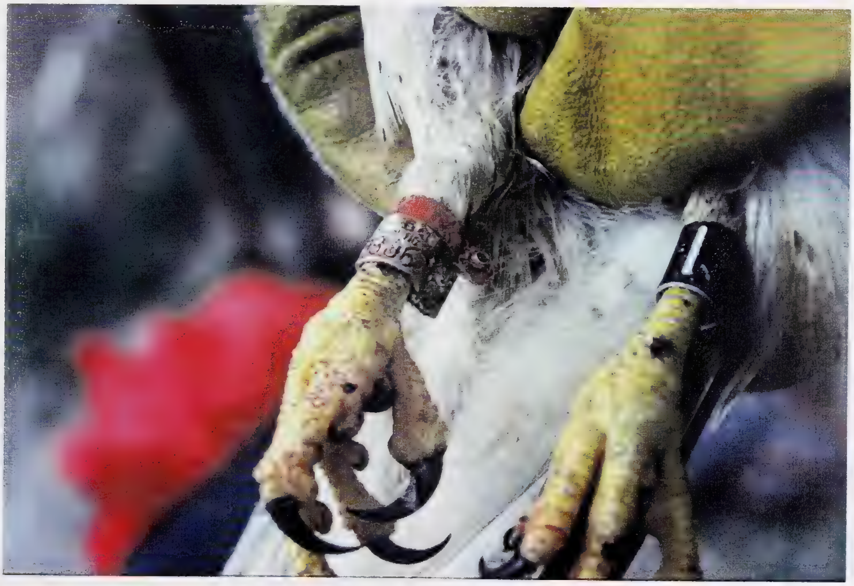
Photograph 2. View of downstream river valley looking west. The dam is in the upper right-hand corner of photograph. Note riparian poplar vegetation that was left in downstream borrow area.

Photograph 3. Douglas fir along south shore near dam. Slope was hand cleared to protect remaining Douglas fir.

Photograph 4. Clover trap used to capture adult mule deer to install radio-collars and measure biological parameters.

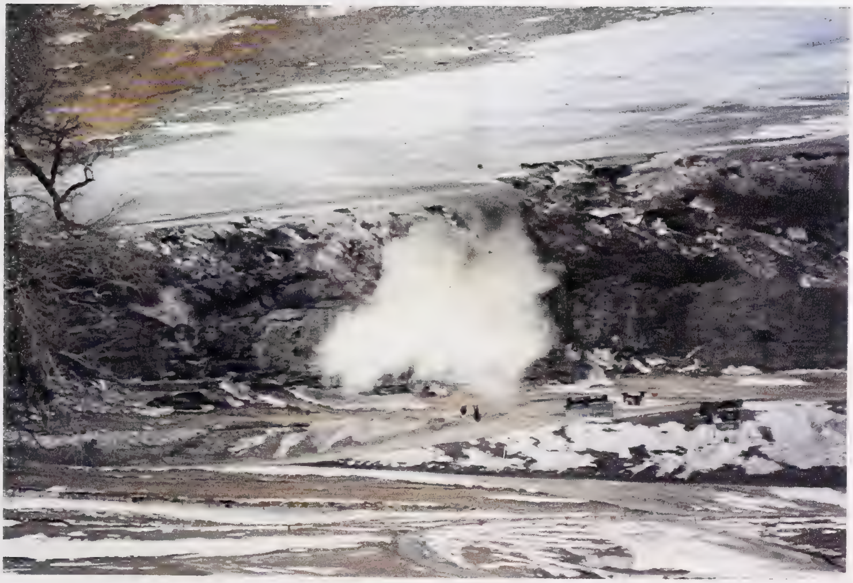


Photograph 5. Crown of snares on stuffed great horned owl used to capture adult prairie falcons.



Photograph 6. Bands were placed on all young of year and most adult prairie falcons. Aluminum band is U.S. F.&W. band. Colored bands identify year of birth (for young of year) to facilitate visual recognition from the ground.

Photograph 7. Crew drilling hard sandstone to prepare for blasting hole for prairie falcon nest site.



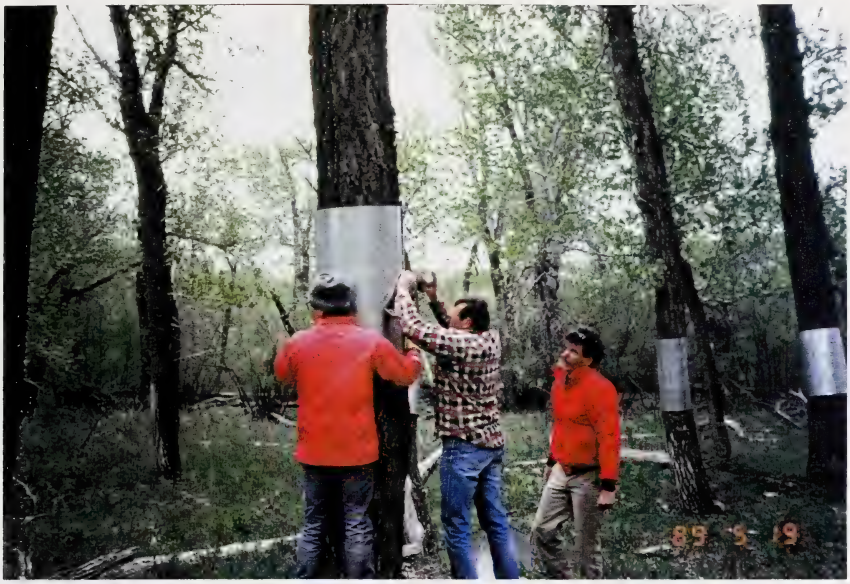
Photograph 8. Blasting prairie falcon nest site along Oldman River downstream of dam.

Photograph 9. Crew excavating falcon nest hole in clay till cliff along Castle River.

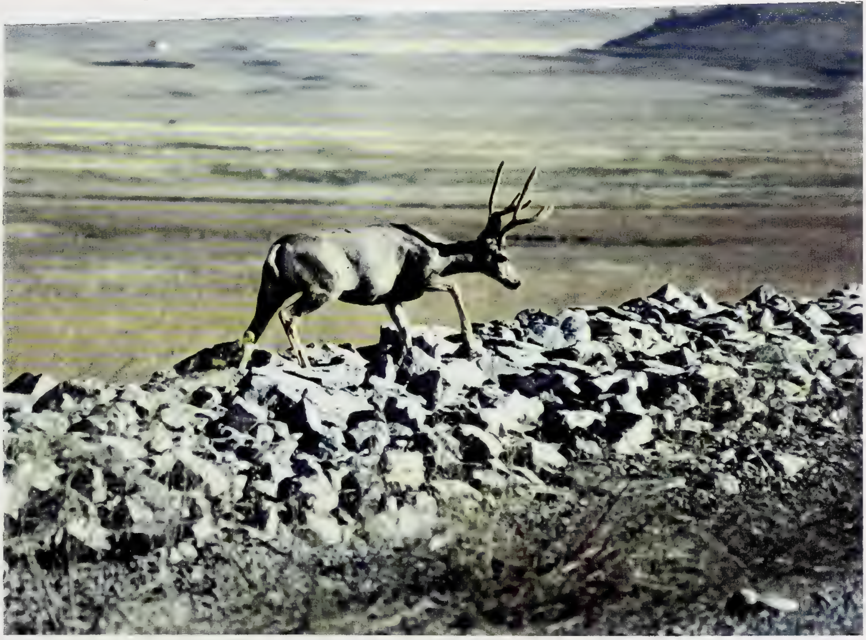
Photograph 10. Crew enlarging natural cavity in soft sandstone and blocking lateral access for prairie falcon nesting along the Oldman River downstream of the dam.

Photograph 11. Crew installing wood duck nesting boxes in riparian poplar downstream of reservoir.

Photograph 12. Crew installing nesting platform for hawks within mitigation land base.



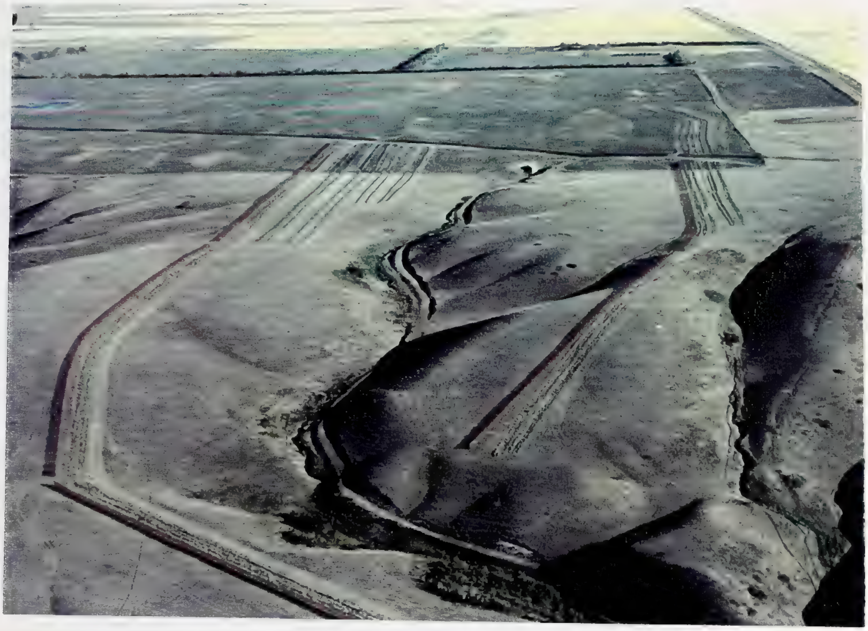
Photograph 13. Crew installing aluminum flashing on trees to protect heron colony from ground based predation.



Photograph 14. Mule deer having difficulty crossing rip rap on dyke. Gravel strips were installed over the rip rap to facilitate this movement.

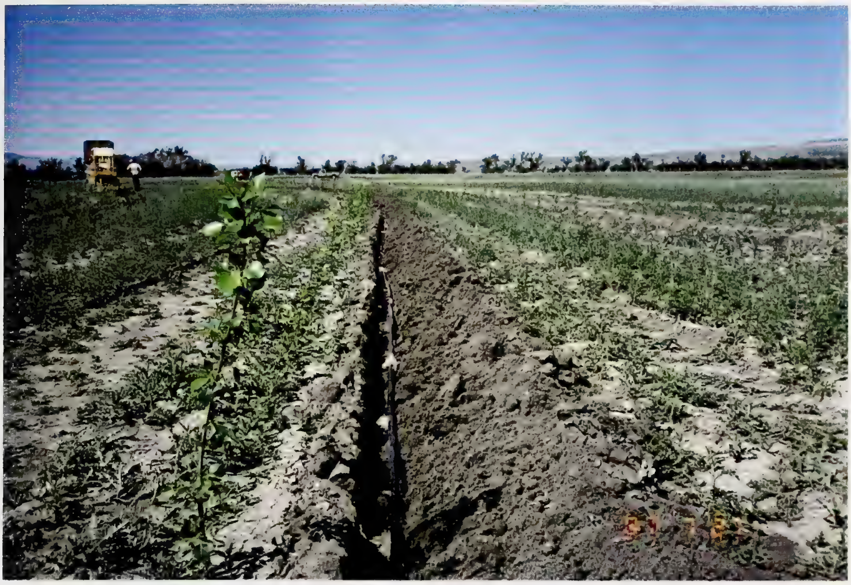
Photograph 15. Unpainted stow fence.

Photograph 16. Sub-soiler opening ground behind snow fences.

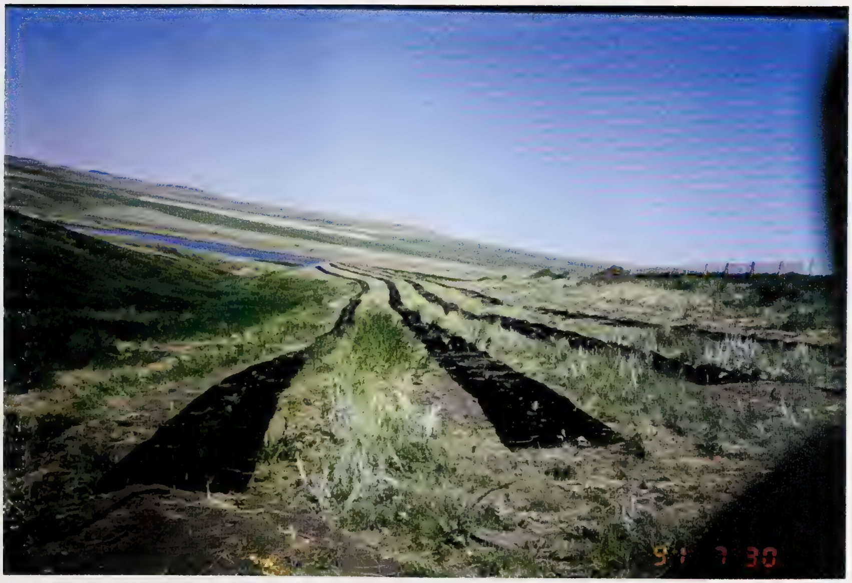


Photograph 17. OS17. Shelterbelt planting. Snow fence on windward side to reduce wind stress. Dark green area seeded grass. Lighter area native grass.

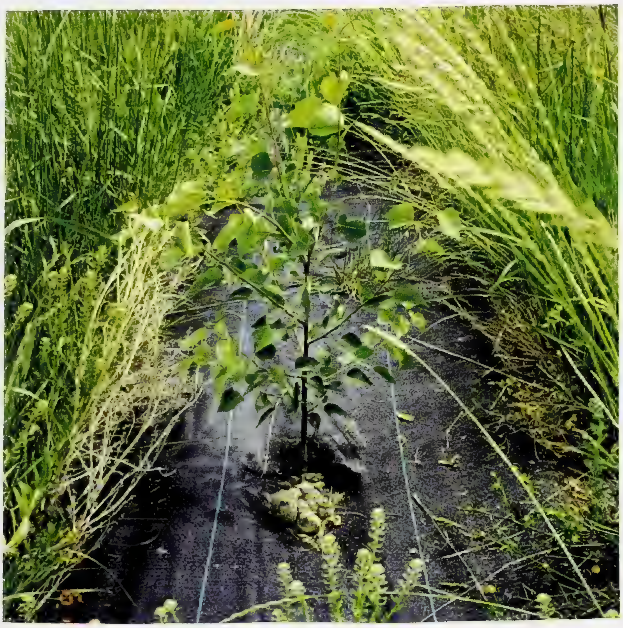
Photograph 18. OS17. Close-up of shelterbelt planting.



Photograph 19. OS17. Installation of permanent irrigation system. Low flow emitters were installed adjacent to shelter belt plantings. Emitters are wrapped with fiberglass insulation to prevent root penetration.



Photograph 20. OC16-C01. Weed barrier fabric used to reduce weed and grass competition for newly-planted seedlings. Seedlings planted on contours to allow gravity flow of water through emitter tubing beneath the filter fabric.

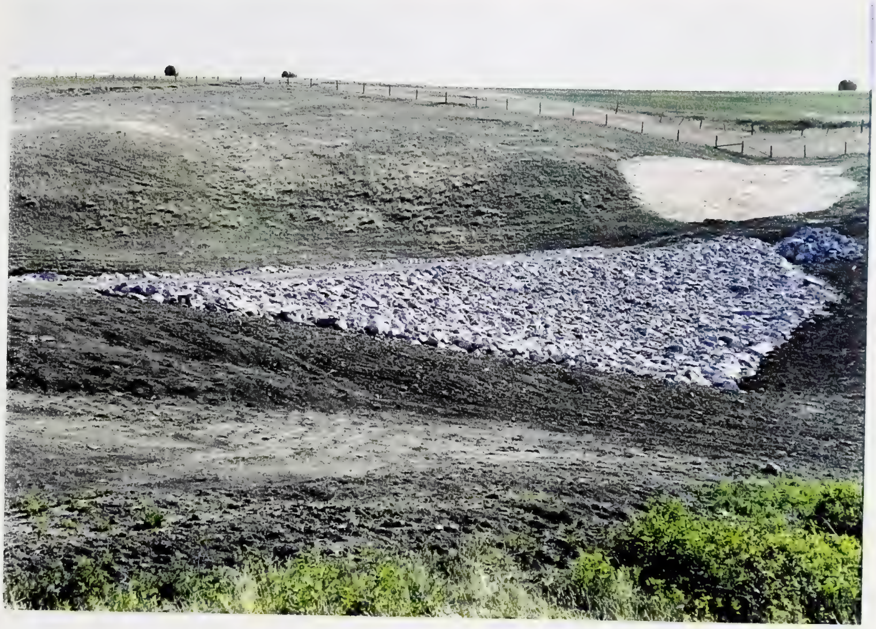


Photograph 21. Aspen seedling planted through a “weed barrier” mulch.

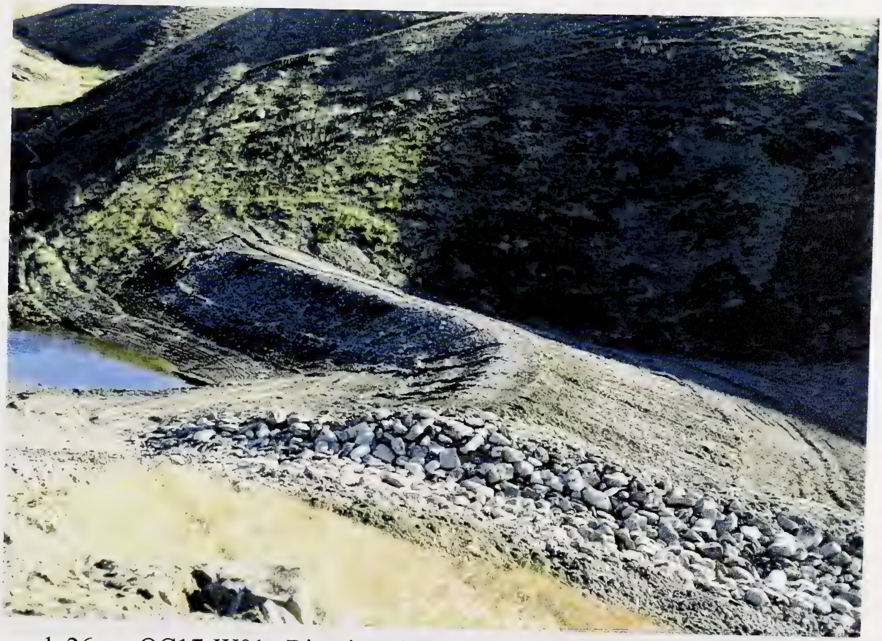
Photograph 22. Mule deer eating seedlings in recovering tame pasture. Snow fence is on other side of planted seedlings.

Photograph 23. Typical construction of wetlands.

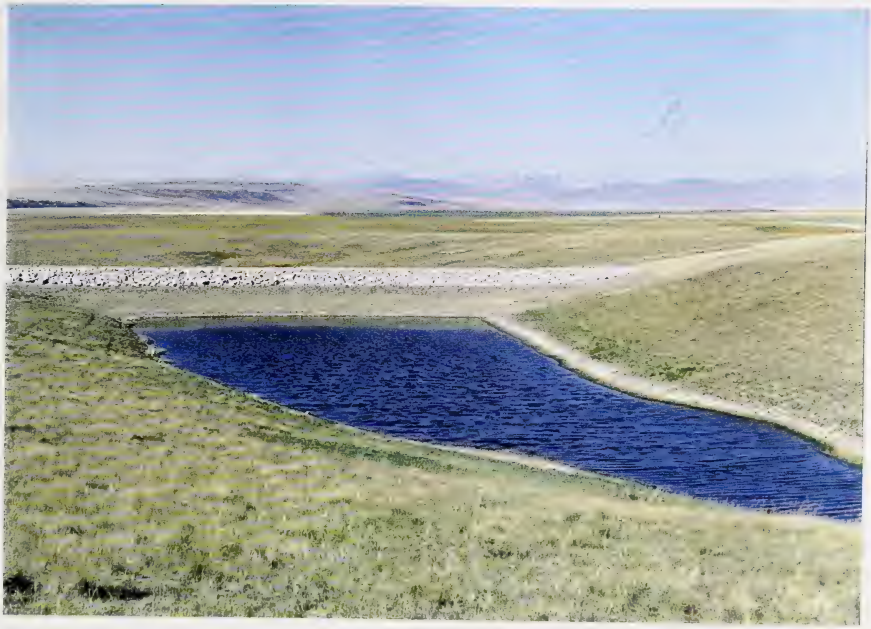
Photograph 24. ON02-W01. Wetland constructed from waste material from bridge construction on Oldman River.



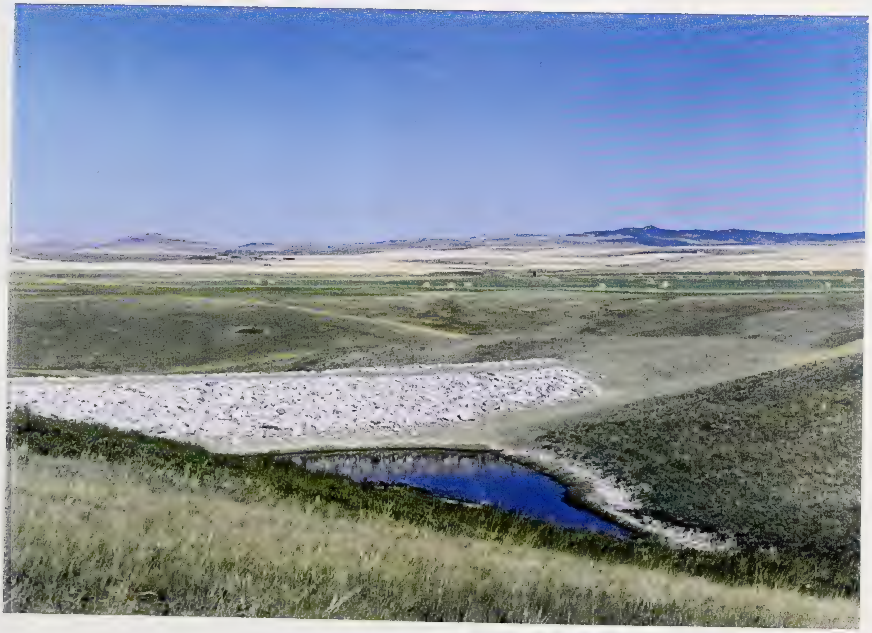
Photograph 25. OS52-W01. Riparian check dam after construction.



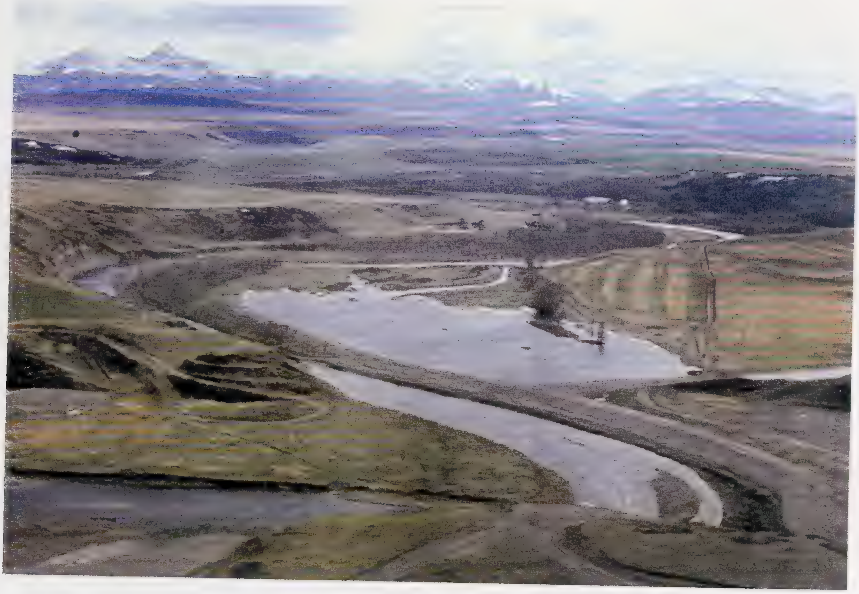
Photograph 26. OC17-W01. Riparian check dam. Rock spillway cut into abutment.



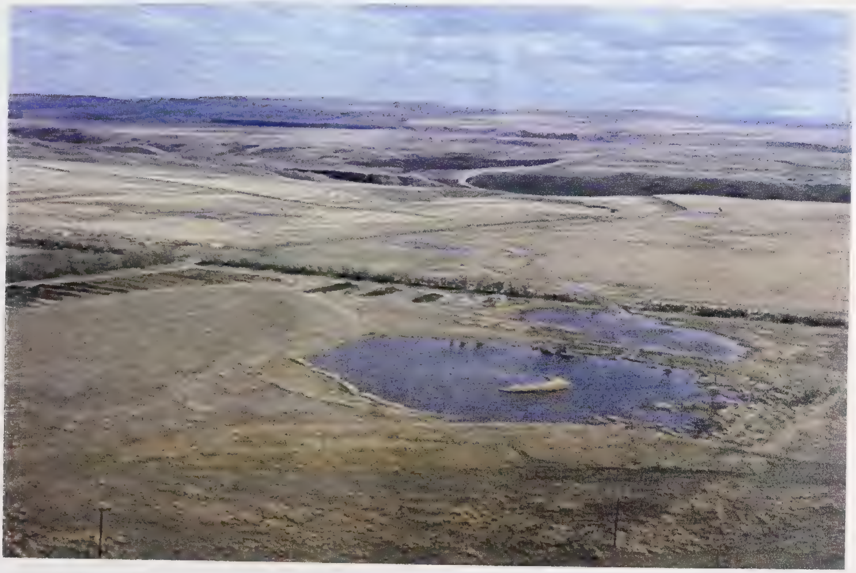
Photograph 27. OS54-W01. Riparian check dam along coulee feeding leading into reservoir. Reservoir back floods into wetlands.



Photograph 28. OS54-W02. Riparian check dam along coulee feeding leading into reservoir. Unlined spillway to right of dam



Photograph 29. C11-W01. Riparian dyke along Castle River. Water levels managed through canal from Castle River.

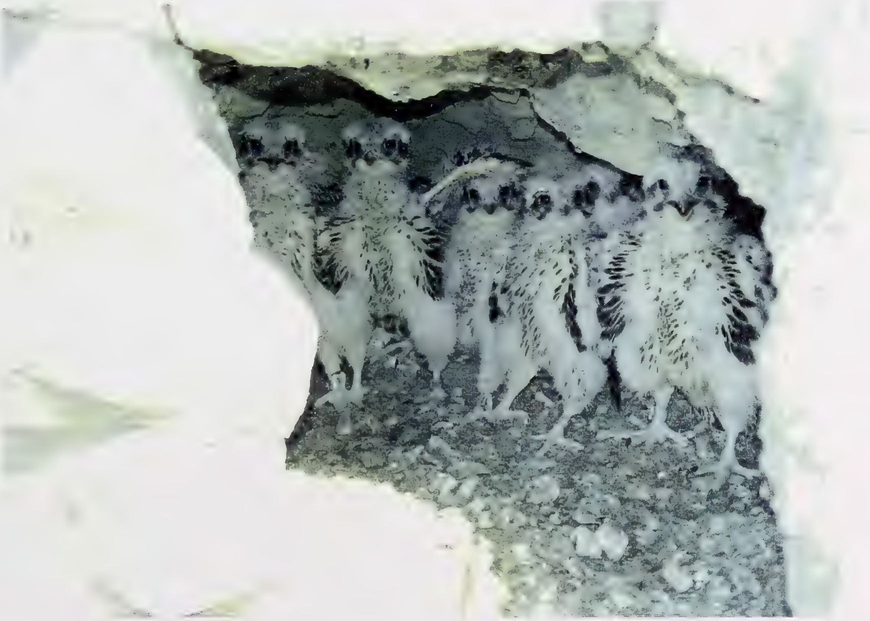


Photograph 30. OS17. Four wetlands that are enhanced through pumped water from the Oldman River.

Photograph 31. South shore of Oldman River Reservoir along the Oldman River main stem. Douglas Fir where grazing is managed along with adjacent lands.

Photograph 32. South of the Oldman River Reservoir along the Crowsnest River. Existing shrub vegetation that is protected from grazing to allow recovery.

Photograph 33. Richard Fyfe holding young owl that had just been rescued during initial filling of the reservoir. Rescued animals were sent to the Coaldale Raptor Centre.



Photograph 34. Prairie falcon brood in an artificial nest cavity. The taller two fledglings are from three introduced eggs, recovered from a nest that was about to be flooded in 1991.

APPENDIX B

HABITAT SUITABILITY INDEX MODELS

Contents

1987 Mule Deer Model*
1995 Mule Deer Model*
Sharp-tailed Grouse Model*
Mallard Model*
White-tailed Jackrabbit Model*

*Detailed SI curves are found in Delta (1987) and Axys (1995)

1987 Mule Deer Model (Delta 1987)

$$HSI_{Winter} = V_{MD1}SI \text{ x } (0.7\ V_{MD3}SI + 0.3 \text{ x } V_{MD4}SI)$$
$$HSI_{Summer} = V_{MD2}SI \text{ x } (0.7\ V_{MD3}SI + 0.3 \text{ x } V_{MD4}SI)$$

1995 Mule Deer Model (Axys 1995)

$$HSI_{Winter} = ((0.6 \text{ x } HSI_{Winter\ Food}) + (0.4 \text{ x } V_{MD10}SI \text{ x } V_{MD11}SI)) \text{ x } V_{MD3}SI \text{ x } V_{MD12}SI$$
$$HSI_{Summer} = ((0.7 \text{ x } HSI_{Summer\ Food}) + (0.3 \text{ x } V_{MD10}SI \text{ x } V_{MD11}SI)) \text{ x } V_{MD3}SI \text{ x } V_{MD12}SI$$
$$HSI_{Winter\ Food} = (0.5 \text{ x } V_{MD7}SI \text{ x } V_{MD8}SI) + (0.5 \text{ x } V_{MD5}SI \text{ x } V_{MD6}SI)$$
$$HSI_{Summer\ Food} = (0.6 \text{ x } V_{MD7}SI \text{ x } V_{MD8}SI) + (0.4 \text{ x } V_{MD9}SI)$$

Variables

V_{MD1}	Vegetation Type (different winter SI values)
V_{MD2}	Vegetation Type (different summer SI values)
V_{MD3}	Grazing Intensity (common to both models)
V_{MD4}	Aspect
V_{MD5}	Percent Shrub Canopy Cover
V_{MD6}	Percent Canopy Cover Comprised of Preferred Browse Species
V_{MD7}	Percent Ground Cover of Graminoids
V_{MD8}	Percent Fescue Ground Cover
V_{MD9}	Percent Ground Cover of Forbs
V_{MD10}	Percent Canopy Cover of Trees and/or Shrubs
V_{MD11}	Height of Tree or Shrub Canopy
V_{MD12}	Aspect (different SI curve)

Sharp-tailed Grouse Model (Axys 1995)

$$HSI_{\text{Food and Cover}} = ((0.5 \text{ x } (V_{ST1}SI)) + (0.5 \text{ x } V_{ST2}SI \text{ x } V_{ST3}SI)) \text{ x } V_{ST4}SI$$

Variables

V_{ST1}	Percent Ratio of Shrub/Trees to Grassland
V_{ST2}	Percent Ground Cover of Graminoids
V_{ST3}	Height of Nesting Cover
V_{ST4}	Proximity of Potential or Identified Lek

Mallard Model (Axys 1995)

$$HSI_{\text{Nesting Sub-Model}} = ((0.25 \text{ x } V_{M1}SI) + (0.25 \text{ x } V_{M2}SI)) + (0.5 \text{ x } HSI_{\text{Nesting Cover}})$$

$$HSI_{\text{Brood Rearing Sub-Model}} = ((0.25 \text{ x } V_{M1}SI) + (0.25 \text{ x } V_{M2}SI)) + (0.5 \text{ x } HSI_{\text{Rearing Cover}})$$

$$HSI_{\text{Nesting Cover}} = ((0.5 \text{ x } V_{M3}SI) + (0.5 \text{ x } V_{M4}SI)) \text{ x } V_{M5}SI$$

$$HSI_{\text{Rearing Cover}} = ((0.6 \text{ x } V_{M1}SI) + (0.4 \text{ x } V_{M6}SI)) \text{ x } V_{M7}SI$$

Variables

V_{M1}	Percent Emergent Vegetation Cover
V_{M2}	Percent Submergent Vegetation Cover
V_{M3}	Percent Vascular Ground Cover
V_{M4}	Vascular Plant Height
V_{M5}	Wetland Proximity
V_{M6}	Patton's Diversity Index
V_{M7}	Wetland Size

White-tailed Jackrabbit Model (Axys 1995)

$$\mathrm{HSI}_{\text{food and cover}} = (0.7 \text{ x } (V_{JR1}\mathrm{SI} \text{ x } V_{JR2}\mathrm{SI}) + 0.3 \text{ x } (V_{JR3}\mathrm{SI}))$$

Variables

V_{JR1}	Percent Ground Cover of Vascular Plants
V_{JR2}	Percent Cover Comprised of Preferred Plant Species
V_{JR3}	Percent Canopy Cover of Trees and Shrubs

APPENDIX C

EXECUTIVE SUMMARIES OF SELECTED REPORTS AND NEWS RELEASE

Contents

Phase 1 Wildlife Overview for the Oldman River Dam Environmental Mitigation/Opportunities Plan. Westworth & Associates Ltd. 1985.

A Strategy for Wildlife Habitat Mitigation in the Oldman River Dam Reservoir. The Delta Environmental Management Group Ltd. 1989.

An Action Plan for Wildlife Habitat Mitigation for the Oldman River Dam Reservoir. Alberta Public Works, Supply and Services and The Delta Environmental Management group Ltd. 1989

Oldman River Dam Project - Report Release - Wildlife Habitat Mitigation. Government of Alberta News Release, January 25, 1989

The Oldman River Dam Wildlife Evaluation and Monitoring Program. The Delta Environmental Management Group Ltd. 1991

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Oldman River Dam Project - Report Release - Wildlife Habitat Mitigation. Government of Alberta News Release, January 25, 1989

The Oldman River Dam Wildlife Evaluation and Monitoring Program. The Delta Environmental Management Group Ltd. 1991

PHASE I WILDLIFE OVERVIEW FOR THE OLDMAN RIVER DAM ENVIRONMENTAL MITIGATION / OPPORTUNITIES PLAN

Alberta Environment
Planning Division

D.A. Westworth and L.M. Brusnyk

D.A. Westworth & Associates Ltd.
Edmonton, Alberta

March 1985

EXECUTIVE SUMMARY

As part of Alberta Environment's continued planning for development of the Oldman River Dam, D.A. Westworth & Associates Ltd. were asked to prepare a Phase 1 Wildlife Overview report for the project area. The report includes a review of existing information on the wildlife resources of the Three Rivers site, summarizes potential impacts and mitigation strategies that have been identified to date, and identifies major data gaps and required studies.

The project area is transitional between prairie grassland and montane ecoregions. Natural habitats within the 2350 ha reservoir area include riparian forest and shrub communities associated with the relatively narrow floodplains of the Oldman, Crowsnest and Castle Rivers, and grasslands and shrub communities associated with the valley slopes. Adjacent uplands contain native grasslands interspersed with cultivated lands. A detailed habitat inventory of the project area has not yet been conducted and there is a remaining need for accurate, large scale mapping of the affected habitat.

The most important issue with respect to the impact of the project on wildlife, concerns the effects of habitat loss on local and regional ungulate populations. Portions of the project area have been identified as critical habitat for mule deer and white-tailed deer. An aerial survey of the damsite and lower reservoir area in January 1982 indicated that this portion of the Oldman River valley provides important winter habitat for mule deer, with an observed density of approximately 5.7 mule deer per sq km. For most of the project area however, data on the abundance and seasonal distribution of ungulates are lacking. As a result, it is not known whether the area provides critical seasonal habitat for animals inhabiting surrounding areas or whether these valley segments are important as movement or migration corridors for ungulates. Surveys are required to determine seasonal habitat use and present habitat suitability within the project area and within adjacent habitat areas that are likely to be affected by the project.

With the exception of coyote and red fox, capability of the area for most commercially important species of furbearers is considered low. The area currently receives a limited amount of trapping activity, although the amount of fur harvested is not known. Required studies include: determining the commercial value of fur harvested in the project area, identifying carnivore denning areas that

would be affected by the project, and determining the status of the long-tailed weasel, a species that now occurs on the endangered species list.

The capability of the area for waterfowl production is very low due to the high velocities of the rivers and the lack of permanent wetlands in the surrounding uplands. The major concern is the potential loss of nesting habitat for Canada geese. Geese are known to nest on islands and ledges along this portion of the Oldman River, although the extent of nesting habitat and amount of goose production in the project area has not been determined. Surveys are required to quantify use of the area by geese and to determine the availability of alternative, unoccupied nest sites upstream and downstream from the reservoir area.

While a number of raptor species are known to nest in the general area, the major concern is the loss of prairie falcon nest sites within the project area. Although the prairie falcon is not considered endangered, this species is on the COSEWIC status list and is closely monitored by provincial and federal wildlife agencies. Four known nest sites are situated in areas that may be affected by the project. Surveys are required to determine which of the active nest sites are at risk and to develop mitigation strategies for securing existing nest sites or providing alternate nest sites.

The status of other terrestrial bird species in the project area is largely unknown. Sharp-tailed grouse are the only upland game bird species expected to make extensive use of the proposed reservoir area. Surveys are required to determine whether any dancing grounds occur within areas that might be affected by the project. Surveys were also recommended to evaluate the importance of affected habitats for songbirds, since this group of birds are an increasingly important recreational resource and riparian cottonwood communities have been widely recognized as exceptionally productive avian habitats.

No information exists on the abundance or distribution of herpetofauna in the project area. Species of potential concern are the northern leopard frog and western painted turtle, which are currently considered threatened or endangered in Alberta. Surveys are recommended to determine the status of these species in the project area, and to determine whether any hibernacula for garter snakes are at risk with respect to the project.

A STRATEGY FOR
WILDLIFE HABITAT MITIGATION
FOR
THE OLDMAN RIVER DAM RESERVOIR

by

Jeffrey E. Green, P. Biol.

and

T. Ross Eccles, P. Biol.

The Delta Environmental Management
Group
Calgary, Alberta

for

The Oldman River Dam Project Office,
Alberta Public Works, Supplies and
Services
Edmonton, Alberta

January 1989

EXECUTIVE SUMMARY

In August 1984, the Government of Alberta announced that the Oldman River Dam would be constructed on the Oldman River. To ensure that environmental concerns resulting from the construction and operation of the reservoir were approached in a systematic and objective manner, Alberta Environment[1] set out a framework for a series of studies leading to the formulation of an Environmental Mitigation/ Opportunities Plan.

The Wildlife Component of the Environmental Mitigation/Opportunities Plan began in 1985 and 1986 with a review of available information, followed by field surveys. Because of the importance of the flooded area to wildlife, the Government of Alberta is working cooperatively with a local Fish and Widlife Sub-committee to design and implement a Wildlife Habitat Mitigation Program that will create and improve wildlife habitat around the reservoir.

The major objectives of the Wildlife Habitat Mitigation Plan are:

1. *To minimize the potential negative impacts of the Oldman River dam project on wildlife species, and*
2. *To take advantage of mitigation opportunities arising from the development of the dam and reservoir.*

The Delta Environmental Management Group Ltd. (The Delta Group) was retained to identify opportunities for wildlife habitat mitigation in the vicinity of the reservoir area and, on the basis of this inventory, develop practical and effective projects to protect, enhance or create wildlife habitat for implementation during 1988 to 1993.

Assumptions and Constraints to the Mitigation Plan

A number of assumptions are central to the development and implementation of the Wildlife Habitat Mitigation Plan:

1. *Wildlife habitat mitigation is defined as compensation for losses of wildlife habitat, that are incurred during the construction of the Oldman River dam and subsequent flooding of the reservoir, through the provision of alternate cover and/or cover/food habitat.*
2. *A suitable land base will be maintained under crown control for wildlife habitat mitigation purposes.*
3. *The Government of Alberta is committed to the long-term maintenance and management of the Wildlife Habitat Mitigation Program and land base.*
4. *If construction activities and reservoir operations provide opportunities for wildlife habitat mitigation, practical and cost-effective habitat projects will be considered for design and implementation as these opportunities arise.*

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[1] *As of November 1988, responsibility for construction of the Oldman River Dam Project was transferred from the Development and Operations Division of Alberta Environment to Alberta Public Works, Supplies and Services. Depending on the date of the reference, Alberta Environment and Alberta Public Works, Supplies and Services are therefore referred to as the project proponent.*

5. *The habitat mitigation plan will benefit a wide diversity of wildlife.*

6. *Wildlife habitat projects will be well distributed around the reservoir.*

7. *Wildlife habitat projects will include movement corridors for wildlife between core habitat areas around the reservoir area.*

8. *Wildlife habitat projects will be compatible with existing land uses.*

9. *In the event that an essential wildlife project is not feasible due to land ownership, incompatible land uses, and/or conflicts with construction activities, alternate habitat opportunities will be considered.*

10. *Downstream wildlife habitat mitigation opportunities will be considered in conjunction with the reservoir operational plan.*

11. *An assessment program will be implemented to monitor and evaluate wildlife habitat mitigation projects.*

Estimating Losses of Wildlife Habitat

*Through the use of habitat evaluation models that simultaneously consider habitat quality and availability, it is estimated that **689 Habitat Units (HUs)** will be lost to flooding. (One HU is equivalent to one hectare of optimal habitat.) In terms of the specific uses of these habitats by tree and shrub associated wildlife:*

- ***38 HUs** provide mostly cover (for example, Douglas fir communities),*
- ***445 HUs** provide mostly food (communities such as grasslands, cultivated fields and low shrubland areas), and*
- ***206 HUs** provide both cover and food (communities such as aspen and cottonwood stands and tall shrubland areas).*

Because of the importance of winter cover for tree and shrub associated wildlife, the principal focus of the Wildlife Habitat Mitigation Plan is to enhance or create cover and cover/food habitat.

Mitigation Techniques

Three groups of mitigation techniques will be used to compensate for losses of wildlife habitat that are incurred during the construction of the Oldman River dam and the flooding of the reservoir:

- *habitat protection*
- *habitat enhancement, and*
- *creation of new habitat*

Habitat protection measures are intended primarily to conserve and protect bottomland, upland and coulee habitats for wildlife. Three habitat protection measures are proposed: perimeter fencing of the land base for the Wildlife Habitat Mitigation Program, implementation of range management plans for integrated use of pasturelands by wildlife and cattle, and development of reservoir clearing guidelines to minimize losses of tree and shrub habitats that will not be substantially affected by the flooding of the reservoir.

Habitat enhancement projects involve the improvement and/or expansion of existing sites and habitats to provide more suitable and/or larger areas of habitat for *terrestrial and wetland wildlife than which presently exists. Four types of habitat enhancement measures will be incorporated into the Wildlife Habitat Mitigation Plan: enhancement of existing tree and shrub communities, wetland enhancement, modification of nesting cliffs, and improvement of native and seeded range.*

Six methods of creating new habitat for wildlife will be considered for the Wildlife Habitat Mitigation Plan: establishment of new upland tree and shrub communities (including the construction of check dams and irrigation systems), development of new bottomland shrub and tree communities, development of new wetland basins, creation of several islands within the reservoir, construction of rockpiles for marmots, and reclamation of borrow areas.

Preparing a Habitat Mitigation Program for Wildlife

To achieve the objectives of the Wildlife Habitat Mitigation Program, it will be necessary to provide core areas of cover and food for shrub and tree-associated wildlife, as well as movement corridors along the reservoir edge. However, the plan also includes the enhancement and creation of wetlands and check dams to benefit water-associated wildlife, and to provide better growing conditions for transplanted trees and shrubs. Special structures such as rockpiles for marmot burrows, modifications of cliff habitats for relocation of prairie falcon nests, and creation of nesting sites for Canada geese on the reservoir islands have also been incorporated in the plan.

During the initial planning phase of the wildlife habitat mitigation program, a large number (145) of opportunities for protection and enhancement of existing habitat and creation of new habitat were identified in the vicinity of the Oldman reservoir. Opportunities were based only on the existing biophysical site conditions, and the potential to improve existing habitat conditions or create new habitat using proven mitigation methodologies or new technological advances in wildlife habitat mitigation. In contrast, the selection and priorization of mitigation projects for inclusion in the wildlife habitat mitigation plan took into account factors associated with the biological requirements of wildlife, compatibility with adjacent land use, land ownership, project cost, and project effectiveness.

Using these criteria and ongoing input from the Fish and Wildlife Sub-committee, an Action Plan for Wildlife Habitat Mitigation has been prepared as a companion report to this mitigation strategy. The Action plan describes actual projects which will be implemented to provide suitable replacement habitat for wildlife, the implementation schedule for the Wildlife Habitat Mitigation Plan, and an evaluation and maintenance program for the habitat projects.

Integration with other Components of the Oldman River Dam Project

The construction and operation of the Oldman River dam and the implementation of environmental mitigation programs for fisheries, recreation, vegetation, historical resources, agriculture and transportation will afford a broad range of opportunities for interaction and integration with the Wildlife Habitat Mitigation Program. Where possible, all such opportunities will be pursued in order to maximize benefits to the Alberta public.

AN ACTION PLAN FOR WILDLIFE HABITAT MITIGATION FOR THE OLDMAN RIVER DAM RESERVOIR

by
Alan L. Nilson, P.Eng.
Alberta Public Works, Supplies and Services
Edmonton, Alberta

and

Jeffrey E. Green, P. Biol.
The Delta Environmental Management Group
Calgary, Alberta

for

The Oldman River Dam Project Office,
Alberta Public Works, Supplies and Services
Edmonton, Alberta

January 1989

EXECUTIVE SUMMARY

In August 1984, the Government of Alberta announced that the Oldman River Dam would be constructed on the Oldman River, a short distance downstream of the confluence of the Castle, Crowsnest and Oldman rivers. Once completed, the dam will create a reservoir covering an area of 2420 ha at the full supply level (fsl) of 1118.6 m.

To ensure that environmental concerns resulting from the construction and operation of the reservoir were approached in a systematic and objective manner, the Planning Division of Alberta Environment[1] set out a framework for a series of studies leading to the formulation of an Environmental Mitigation/Opportunities Plan (Alberta Environment 1988). Following inventories of wildlife populations and habitats in 1986-87, a strategy for wildlife habitat mitigation was prepared. The wildlife mitigation strategy assessed the amount of habitat lost to flooding and, on the basis of three major types of mitigation methods, inventoried opportunities for habitat mitigation in the vicinity of the reservoir.

An Action Plan for wildlife habitat mitigation for the Oldman Dam Project is presented here as a supplement to the Wildlife Mitigation Strategy. The Action Plan describes actual projects which will be implemented to provide suitable replacement habitat for wildlife, the implementation schedule for the Wildlife Habitat Mitigation Plan, and an evaluation and maintenance program for the habitat projects.

Habitat Mitigation Projects

The major objective of the wildlife habitat mitigation program is to protect and develop habitat for wildlife in order to minimize the impacts of habitat loss associated with flooding of the reservoir. Towards this end, the Wildlife Habitat Action Plan includes specific projects to protect and enhance core habitat areas, develop well-defined movement corridors between the core habitat areas, and enhance and create special use sites such as wetlands and nesting ledges. Mitigation projects in the Wildlife Action Plan are described under three major categories: habitat protection, habitat enhancement and new habitat creation. Details are provided on specific mitigation techniques and project locations.

Implementation Schedule

Completion of the wildlife mitigation program will be constrained by several project activities including:

- *the filling schedule for the reservoir,*
- *attainment of a full operational level for the reservoir, and*
- *propagation of native tree and shrub stock.*

However, as the land base has already been secured for the wildlife habitat mitigation program, most aspects of the mitigation projects involving construction of facilities, excavation, recontouring, and fencing can be completed during the 1987 - 1989 period.

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[1] *As of November 1988, responsibility for construction of the Oldman River Dam Project was transferred from the Development and Operations Division of Alberta Environment to Alberta Public Works, Supplies and Services. Depending on the date of the reference, Alberta Environment and Alberta Public Works, Supplies and Services are therefore referred to as the project proponent.*

Plantings of trees and shrubs will primarily utilize native species from the Oldman River region. To provide stock that is already conditioned to the biophysical conditions in the Oldman River area, cuttings and seeds of trees and shrubs were collected during the spring and summer 1988 for propagation of containerized seedlings, bare root seedlings and cuttings. Species being grown include Douglas fir, limber pine, trembling aspen, black cottonwood, narrow leaf cottonwood, chokecherry, sandbar willow, saskatoon, hawthorn, red osier dogwood, buckbrush, snowberry, and potentilla. Most of these species will be available for planting in 1990 and 1991.

As the full supply level may not be achieved during the first year of reservoir operation (1991), the riparian marshes may not be backflooded from the reservoir until full supply level is attained. As a result, water may need to be provided and maintained by pumping water from the rivers or reservoir. Provision of water in these areas will permit the planting and establishment of riparian trees and shrubs and aquatic vegetation in and around the perimeter of these riparian wetlands, prior to full operation of the reservoir.

Several activities associated with the Wildlife Habitat Mitigation Plan will be ongoing after 1991, including: the planting of remaining tree and shrub seedlings, monitoring and maintenance of vegetation, reclamation activities in borrow sites and construction areas, and remedial measures to specific mitigation projects or project components (as required).

Evaluation and Maintenance

Evaluation of vegetation establishment, performance of structures, wildlife habitat use, and wildlife populations is an integral component of the wildlife mitigation program. As discussed in the Wildlife Mitigation Strategy Report, the wildlife mitigation program is based on a number of assumptions regarding the focus of the mitigation program (i.e., replacement of lost cover and cover/food habitats), the orientation of the mitigation program to key species of wildlife (i.e., mule deer and waterfowl), the integration of wildlife projects with some agricultural land uses and recreation, the composition of native vegetation communities, the suitability of local soil for establishment of woody cover and wetlands, and future land management responsibilities.

Monitoring of the wildlife mitigation projects and the responses of wildlife to the mitigation plan is necessary to ensure that adequate compensation is provided for lost habitat in the reservoir area. In particular, the monitoring program will assess whether specific habitat projects have been implemented or constructed according to the design standards, the success of individual habitat projects in providing habitat for wildlife, and the degree to which wildlife are utilizing habitat projects. In the event that deficiencies or problems are detected during the monitoring program, appropriate corrective measures will be implemented. Further monitoring will reveal if the corrective measures have been successful.

The monitoring program will consist of three major components, including (1) annual assessments of vegetation establishment, (2) assessments of wildife responses to dam construction and reservoir filling, and wildlife use of specific habitat mitigation projects, and (3) audits of habitat projects to determine if the habitat objectives of specific projects are being achieved, and that specific project components are performing as planned.

The Development and Operations Division of Alberta Environment and the Fish and Wildlife Division of Alberta Forestry, Lands and Wildlife will jointly administer the monitoring program for the Wildlife Habitat Mitigation Program, and be responsible for the long-term maintenance and management of the wildlife mitigation projects.

Alberta NEWS RELEASE

GOVERNMENT OF ALBERTA

RELEASE DATE: **January 25, 1989**

SUBJECT: **OLDMAN RIVER DAM PROJECT - REPORT RELEASE WILDLIFE HABITAT MITIGATION**

Two reports; the first outlining the opportunities to mitigate wildlife habitat in the area of the Oldman River Dam and Reservoir and the second describing actual mitigation projects that will be implemented, were released today by the Minister of Public Works Supply and Services, Ernie Isley and LeRoy Fjordbotten, Minister of Forestry, Lands and Wildlife.

A Strategy for Wildlife Habitat Mitigation in the Oldman River Dam Reservoir, was prepared by the Delta Environmental Management Group Ltd. of Calgary. It recommends practical and effective habitat projects designed to enhance, create or protect wildlife habitat in the area around those portions of the Castle, Crowsnest and Oldman Rivers that will be flooded by the Oldman River Reservoir. This strategy was developed in consultation with Alberta Environment, the Fish and Wildlife Division of Alberta Forestry, Lands and Wildlife, the Local Advisory Committee and the Municipal District Fish and Wildlife Sub-Committee. It presents the steps taken in developing the wildlife habitat mitigation plan and outlines the general objectives and scope of the study, impact of the project on wildlife habitat, the subsequent habitat needs and the strategy designed to meet these needs.

A second report entitled An Action Plan for Wildlife Mitigation for the Oldman River Dam Reservoir, which was cooperatively prepared by Alberta Public Works, Supply and Services and the Delta Environmental Management Group, describes the actual projects which will be implemented to provide suitable replacement habitat for wildlife. The plan includes specific projects to protect and enhance core habitat areas, develop well-defined movement corridors between the core habitat areas, and enhance and create special use sites such as wetlands and nesting ledges. A land base of approximately 2,300 acres has been acquired for this purpose.

In releasing the report, Mr. Isley stated that, "The implementation plan outlined in these reports will help us meet our objectives of minimizing the impact on wildlife species and taking advantage of opportunities arising during construction to create wildlife habitat".

"This plan involves a number of specialized projects which will help us protect, create and enhance wildlife habitat that will be affected by the flooding of the reservoir", Mr. Fjordbotten added. "It is a comprehensive plan, applying habitat enhancement or creation solutions specifically designed for a particular locale. My colleague Mr. Isley and I have agreed that the project will be funded to its completion."

"We have estimated at this time a total cost of up to $2.2 million for the wildlife mitigation program", Mr. Isley stated. "Throughout the 1988 to 1993 implementation time period we will continue to obtain input from wildlife experts and local committees." he continued.

Based on the inventories of wildlife species and habitat that were conducted by Alberta Environment prior to commencement of the Oldman River Dam Project, this strategy and action plan recognize and address the needs of a wide variety of wildlife species for movement corridors, overwintering habitat, food, water, protected nesting sites and wetlands. The plan also addresses the needs of the local ranching community for pasture areas, and incorporates range management methods to permit the use of some areas by both cattle and wildlife. The plan involves proven biological techniques, commonly used in other wildlife enhancement projects in the province, as well as state-of-the-art techniques for enhancement and creation of wildlife habitat in the extreme climatic conditions in the Oldman River area.

"We have already begun to implement some of these mitigation techniques on the upper reaches of the reservoir and downstream from the dam", Mr. Fjordbotten stated. "All techniques used will be evaluated for their effectiveness on a regular basis from a biological and agricultural point of view."

In addition, watering systems will be used at a number of sites to provide trees and shrubs with a guaranteed water source. Trees and shrubs, native to the Oldman River area, are presently being raised in nurseries for use in the wildlife habitat projects in 1990 and 1991. Native grasses and other suitable plants will also be used in some projects.

"This strategy and action plan show us how economic development and environmental protection can work together to not only maintain, but to actually enhance wildlife habitat and to better manage Southern Alberta's water resources for multi-purpose uses", stated Mr. Isley.

Implementation of the mitigation measures outlined will take place over the next six years. Following the implementation stage projects will be monitored for a three-year period to ensure that vegetation becomes successfully established and that new structures such as checkdams and watering systems are functioning properly. Longer-term monitoring will involve two or more of each type of mitigation project to determine how wildlife have responded to the habitat projects, and how well the habitat projects have become established.

Fred Bradley, M.L.A. for Pincher Creek/Crowsnest commented, "I congratulate the members of the Local Advisory Committee and the Municipal District Fish and Wildlife Sub-Committee for their efforts in the development of this strategy and action plan and look forward to their continued input into its implementation".

A Strategy for Wildlife Habitat Mitigation for the Oldman River Dam Reservoir and An Action Plan for Wildlife Mitigation for the Oldman River Dam Reservoir are available for viewing at the Edmonton and Pincher Creek Oldman River Dam Project offices, the Alberta Environment Planning Offices in Calgary and Lethbridge and at some public libraries (a list is attached).

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For further information, contact:

Anne Marie Downey
Communications Consultant
Oldman River Dam Project Office
Main Flr., Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

(403)422-0326

A STRATEGY FOR WILDLIFE MITIGATION FOR THE OLDMAN RIVER DAM RESERVOIR AND AN ACTION PLAN FOR THE OLDMAN RIVER DAM RESERVOIR ARE AVAILABLE FOR REVIEW AT THE FOLLOWING LOCATIONS:

Alberta Public Works, Supply and Services
Oldman River Dam Project
Main Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Alberta Public Works, Supply and Services
Oldman River Dam Project
Room 221, Provincial Building
782 Main Street
P.O. Box 1540
Pincher Creek, Alberta
T0K 1W0

Alberta Environment
Planning Division
2nd Flr., Deerfoot Square
2938 - 11 Street, N.E.
Calgary, Alberta
T2E 7L7

Alberta Environment
Planning Division
200 - 5th Avenue South
Lethbridge, Alberta
T1J 4C7

Alberta Environment Library
14th Flr., Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Edmonton Public Library
7 Sir Winston Churchill Square
Edmonton, Alberta
T5J 2V4

Calgary Public Library
616 Macleod Trail S.E.
Calgary, Alberta
T2G 2M2

Cardston Municipal Library
P.O. Box 1560
Cardston, Alberta
T0K 0K0

Library
Pincher Creek School Division #29
Lundbreck, Alberta
T0K 1H0

Buchanan Library
Lethbridge Community College
3000 College Drive
Lethbridge, Alberta
T1K 1L0

Claresholm Municipal Library
P.O. Box 548
Claresholm, Alberta
T0L 0T0

Fort Macleod Municipal Library
P.O. Box 1479
Fort Macleod, Alberta
T0L 0Z0

Lethbridge Public Library
810 - 5th Avenue South
Lethbridge, Alberta
T1J 4C4

Bellevue Municipal Library
2138 - 213 Street
Bellevue, Alberta
T0K 0C0

Blairmore Municipal Library
2114 - 127 Street
Blairmore, Alberta
T0K 0E0

Pincher Creek Municipal Library
P.O. Box 1173
Pincher Creek, Alberta
T0K 1W0

Coleman Municipal Library
8502 - 19 Avenue
Coleman, Alberta
T0K 0M0

Bertha Sears
Legislative Library
216 Legislature Building
Edmonton, Alberta

The Oldman River Dam
Wildlife Evaluation
and Monitoring Program

Prepared by

Jeffrey E. Green,
Timothy Van Egmond
and
Robert Berger

The Delta Environmental Management Group Ltd.
Calgary, Alberta

For
Alberta Public Works, Supply and Services
Edmonton, Alberta

27 March 1992

EXECUTIVE SUMMARY

The Government of Alberta is committed to mitigate and monitor the effects of the Oldman River Dam on wildlife. A wildlife monitoring program has been established to evaluate and document the responses of key wildlife species to dam construction, reservoir filling and operation, wildlife use of the habitat mitigation projects, changes in vegetation composition and habitat suitability. Performance audits of habitat mitigation projects are also included.

This report describes the objectives, rationale and recommended methodology for a monitoring program for the Oldman Wildlife Mitigation Program. The monitoring program recommended includes annual surveys of wildlife and wildlife habitat during 1990-1991 to 1993-1994, and biennial surveys from 1995-1996 to 2002-2003. At the completion of the surveys in 2003, the status of the program should be evaluated and future requirements, approach and direction determined.

Goals and Objectives

To provide a context for presentation and discussion of a wildlife monitoring program, the mission and objectives of the Wildlife Habitat Mitigation Program are discussed. The two primary goals of the Wildlife Habitat Mitigation Plan are:

1. *"To minimize the potential negative impacts of the Oldman River dam project on wildlife species, and*

2. *To take advantage of mitigation opportunities arising from the development of the dam and reservoir."*

To meet these goals, the Wildlife Mitigation Program has been completed in four general phases beginning with an overview and data collection, and followed by assessment and mitigation design, mitigation implementation, and monitoring.

Monitoring of Wildlife Populations and Habitat

The proposed wildlife monitoring study for the Oldman River project consists of four major components:

1. monitoring of wildlife responses to reservoir filling;

2. monitoring of wildlife responses to dam construction and operation;

3. monitoring of wildlife responses to the habitat mitigation program; and

4. monitoring of wildlife habitat use and changes to habitat around the reservoir and downstream of the dam.

The first three components focus primarily on surveys of wildlife populations and wildlife sign (e.g., aerial surveys, browse, pellet groups) in the vicinity of the reservoir, and in areas upstream and downstream from the reservoir. The wildlife habitat component focuses primarily on quantitative assessments of vegetation in selected habitat projects, and in native vegetation communities around and downstream of the reservoir.

In order to focus the monitoring program, while also addressing the wide range of habitat needs for wildlife in the Oldman River region, five representative species or groups of wildlife were selected:

- ***Mule Deer*** as a representative of tree and shrub associated wildlife,
- ***Mallard*** as a representative of ducks, geese and other wetland wildlife,
- ***Songbirds*** such as Western Meadowlark as a representative group of shrub and grassland associated wildlife,
- ***Gray Partridge*** as a representative of prairie grasslands, and
- ***Prairie Falcons*** as a representative of cliff-nesting raptors.

As each of these species or groups are common or high profile species in the Oldman River region, the local abundance, distribution and habitat uses by these species in the reservoir area can be compared to regional trends.

The responses of wildlife to dam construction and operation should be monitored utilizing a variety of common survey techniques for these key species or key groups of wildlife. The proposed surveys focus on providing data on species composition and abundance, seasonal distribution and movement patterns, and local habitat use within and around the reservoir and adjacent areas. These data are required to assess observed impacts to key wildlife species and groups, as well as responses by these key species to different types of habitat mitigation projects.

Wildlife Responses to Reservoir Filling

In order to document potential wildlife problems during reservoir filling, ground and water-based surveys of the Oldman reservoir should be conducted during May to June of 1991 and 1992. The surveys would document:

- isolation of animals on outcroppings or islands within the reservoir (e.g., numbers, species, locations);

- concentrations of wildlife in relation to the reservoir edge such as bunching of animals (e.g., mule deer) at traditional crossing points or within patches of tree/shrub cover, attraction of waterfowl to the reservoir, and increased use by beaver;

- mortality of wildlife resulting from drowning; and

- displacement of animals into adjacent areas (e.g., habitat projects, adjacent farm land) and resulting land use conflicts (e.g., crop damage).

Information from the reservoir filling surveys can be used to refine quantitative estimates of the direct impacts of reservoir filling on wildlife populations.

Wildlife Responses to Dam Operations and Habitat Mitigation

In order to document the responses of key wildlife species and groups to the operation of the Oldman reservoir and the establishment of the habitat mitigation projects, regular surveys of wildlife populations and wildlife habitat use should be undertaken. Recommended surveys for monitoring of these key species or wildlife groups are as follows:

Mule Deer
Monitoring surveys for mule deer should include aerial and ground-based surveys during each year of the monitoring program, as well as a radio-collaring and relocation study. Aerial surveys and radio-tracking provide information on the winter distribution and abundance of mule deer in a large geographic area around the reservoir. Aerial surveys are also the only practical method for estimating the regional abundance of deer. Ground-based surveys and radio-tracking provide site specific information on the local distribution and the relative abundance of deer in relation to specific types of habitat projects, and existing natural habitats. The ground-based surveys and radio-tracking also identify local habitat use patterns and movement corridors (i.e., heavily-used trails).

Waterfowl
Monitoring activities for waterfowl should include ground and aerial surveys during each year of the monitoring program. Ground-based surveys provide site-specific information on the local distribution and abundance of waterfowl, as well as identify local habitat use patterns, nesting habitat preference, and nesting and brood rearing success. Aerial surveys provide site specific information on the distribution and abundance of waterfowl on and around the reservoir, and in downstream areas during spring and fall migration. Information on regional changes in the abundance of waterfowl can be obtained from the North American breeding waterfowl surveys that are conducted annually by the Canadian Wildlife Service and the United States Fish and Wildlife Service.

Songbirds and Upland Gamebirds
Monitoring activities for songbirds and upland gamebirds should include ground-based surveys within representative native habitats and habitat mitigation projects within the reservoir study area. Based on these surveys, songbird locations and species compositions can be compared between native and newly-established habitats. Regular monitoring also permits temporal changes in bird densities and species compositions to be assessed within the same habitat.

Raptors
Monitoring activities for raptors should consist of four components: regional surveys of breeding pairs, banding of individual Prairie Falcons and Ferruginous Hawks, disturbance observations, and use of artificial nesting sites. Regional surveys of breeding pairs should be conducted in all years of the proposed monitoring program. Ongoing banding, disturbance observations and monitoring of artificial nest sites is recommended only during the first two to three years after reservoir flooding.

Downstream Wildlife
In order to monitor effects of the operation of the Oldman Dam on wildlife populations in downstream riparian communities, and wildlife use of these habitats, wildlife surveys should be conducted annually along permanent transects

established for the downstream riparian vegetation monitoring program. Surveys focus on several key species or groups of wildlife, including mule deer, raptors, waterfowl, breeding songbirds, upland gamebirds, and amphibians and reptiles. As noted above, additional information on ungulates and waterfowl can be obtained during aerial surveys downstream from the reservoir.

Vegetation Development in Habitat Projects

In order to assess changes in existing and newly-established vegetation and the suitability of habitat for the key wildlife species within the land base for the wildlife habitat mitigation program, the monitoring program should include ground-based vegetation surveys and quantitative habitat modelling.

Ground-based Vegetation Surveys

Habitat surveys consist of two ground-based surveys in late-May and late July depending on weather conditions and associated vegetation development. Surveys should be completed within the land base for the habitat mitigation program, as well as in selected areas downstream of the reservoir. Within the habitat mitigation land base, surveys include a full range of habitat projects including protection of existing native communities, enhancement of existing native communities, and creation of new habitat. At minimum, all core habitat projects and wetland enhancement projects, as well as approximately half of the movement corridor projects and riparian wetland projects should be monitored.

All surveys should be conducted along permanent transects to allow replicate sampling over the duration of the monitoring program. The length and number of transects depend on habitat size, complexity, and configuration, but preference should be given to multiple, short transects rather than few, long transects. Terrestrial vegetation measurements should be conducted in three distinct strata: the tree stratum, shrub stratum and ground cover. Information from these three strata is important in assessing the structure and composition of vegetation communities relative to capability for different key species of wildlife, as well as identifying site-specific problems in vegetation establishment and/or wildlife damage to vegetation.

Habitat Suitability Modelling

Habitat suitability modelling should be employed to estimate (1) habitat losses within the reservoir and other facility sites prior to disturbance; (2) the baseline habitat values for the habitat mitigation land base prior to implementation of habitat protection, enhancement or creation measures; and (3) changes in habitat capability, relative to the baseline habitat values, associated with implementation of the habitat mitigation program. By estimating habitat losses associated with construction and operation of the Oldman River dam and potential habitat gains associated with the habitat mitigation projects (i.e., the net gain in habitat units between the baseline conditions and maturation of the habitat mitigation program), the success of the habitat mitigation program in replacing the lost habitat can be monitored.

The approach to habitat suitability modelling that can be utilized for the Oldman River Dam project is known as Habitat Evaluation Procedures (HEP), and was developed by the U.S. Fish and Wildlife Service as a standardized method of quantifying wildlife habitats for use in impact assessments of proposed water and water resource development projects. The HEP procedure is based on the assumption that certain measurable variables within any habitat type (e.g., percent tree or shrub canopy closure, age and composition of forest stand) are strongly correlated to that habitat's ability to support a given wildlife species (i.e., carrying capacity). Methodologies for selection of key species and development of habitat suitability models for these species are described.

Performance Audits of Wildlife Projects

In addition to annual monitoring of biological features of the habitat mitigation project, the performance of specific components of the habitat mitigation plans, such as perimeter fencing, snowfencing, checkdams, riparian wetland dykes, and subsurface irrigation systems should be monitored.

Assessments of all physical structures in each habitat mitigation project should be conducted, at minimum, on an annual basis. Due to seasonal requirements (e.g., winter versus summer performance), two or more visits to each habitat project may be necessary each year. Assessments of fencing should be conducted on a more frequent basis (i.e., once every 2-8 weeks) to ensure that fencing remains intact and is maintained, and that livestock and people are excluded from designated sensitive areas within the habitat mitigation land base (e.g., critical habitats, monitoring transects and plots).

Reporting

In order to promote consistency in survey techniques, data recording and reporting among years, it is recommended that a detailed progress report be compiled for each year of the monitoring program. The progress report would summarize:

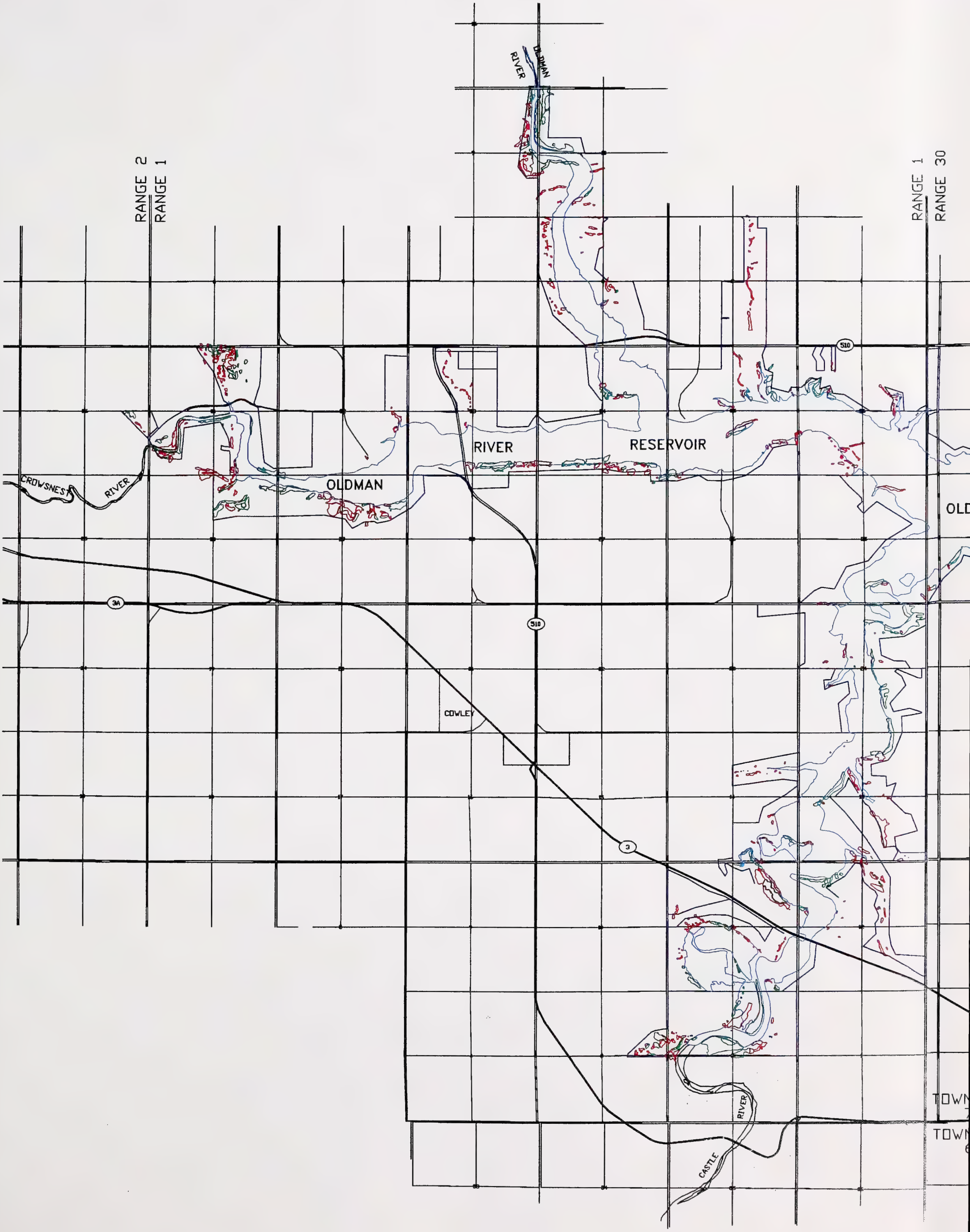
- the specific details of the survey methodology, noting in particular any changes in survey design or methods;
- analyses of the survey results, including comparison with results from all previous monitoring surveys for that monitoring component; and
- recommendations for changes to improve the accuracy or coverage of specific surveys during the next monitoring period.

APPENDIX D

VEGETATION MAPPING

Contents

Figure 1 - Old tree and shrub vegetation
Figure 2 - Regenerating tree and shrub vegetation
Figure 3 - Planted tree and shrub vegetation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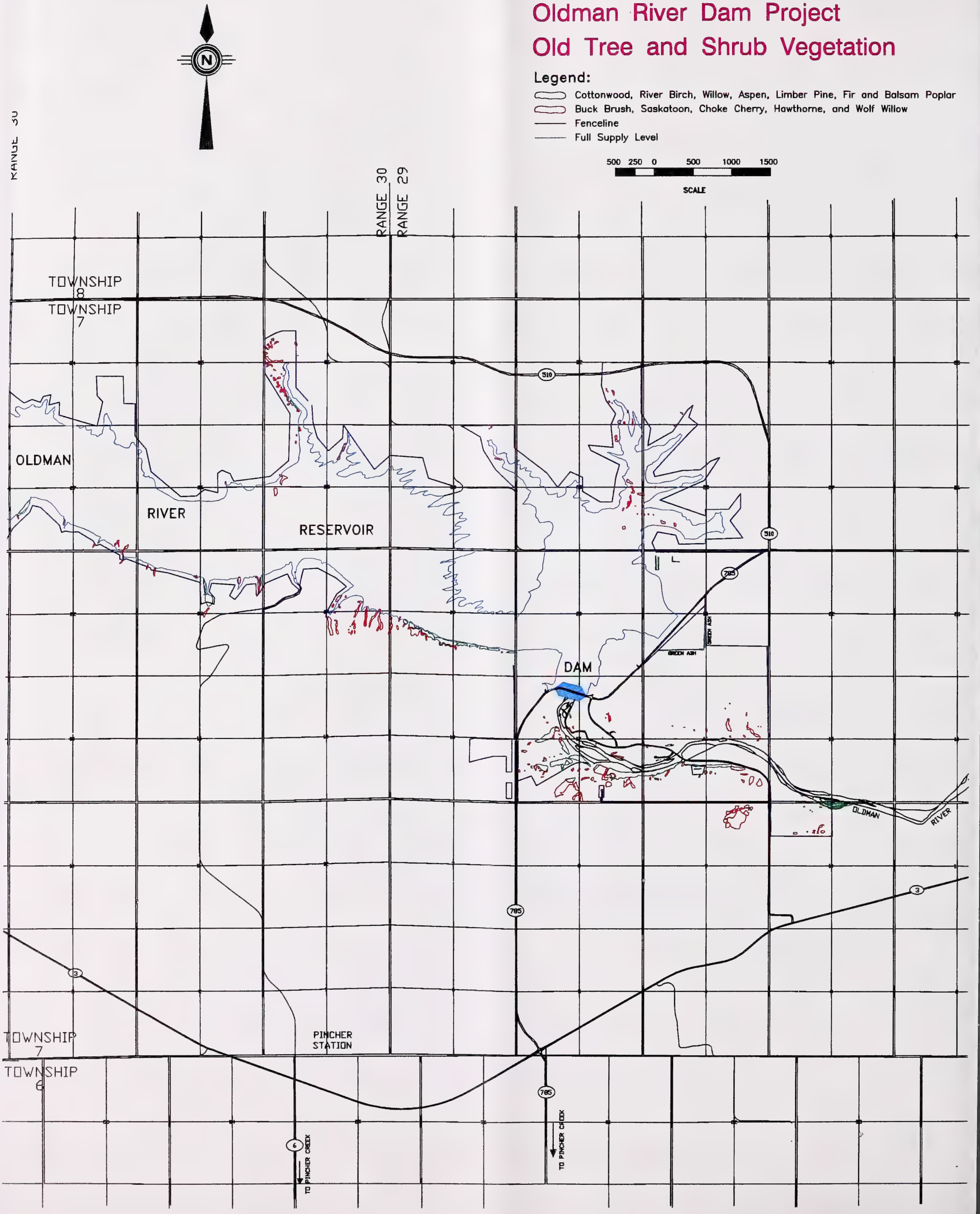
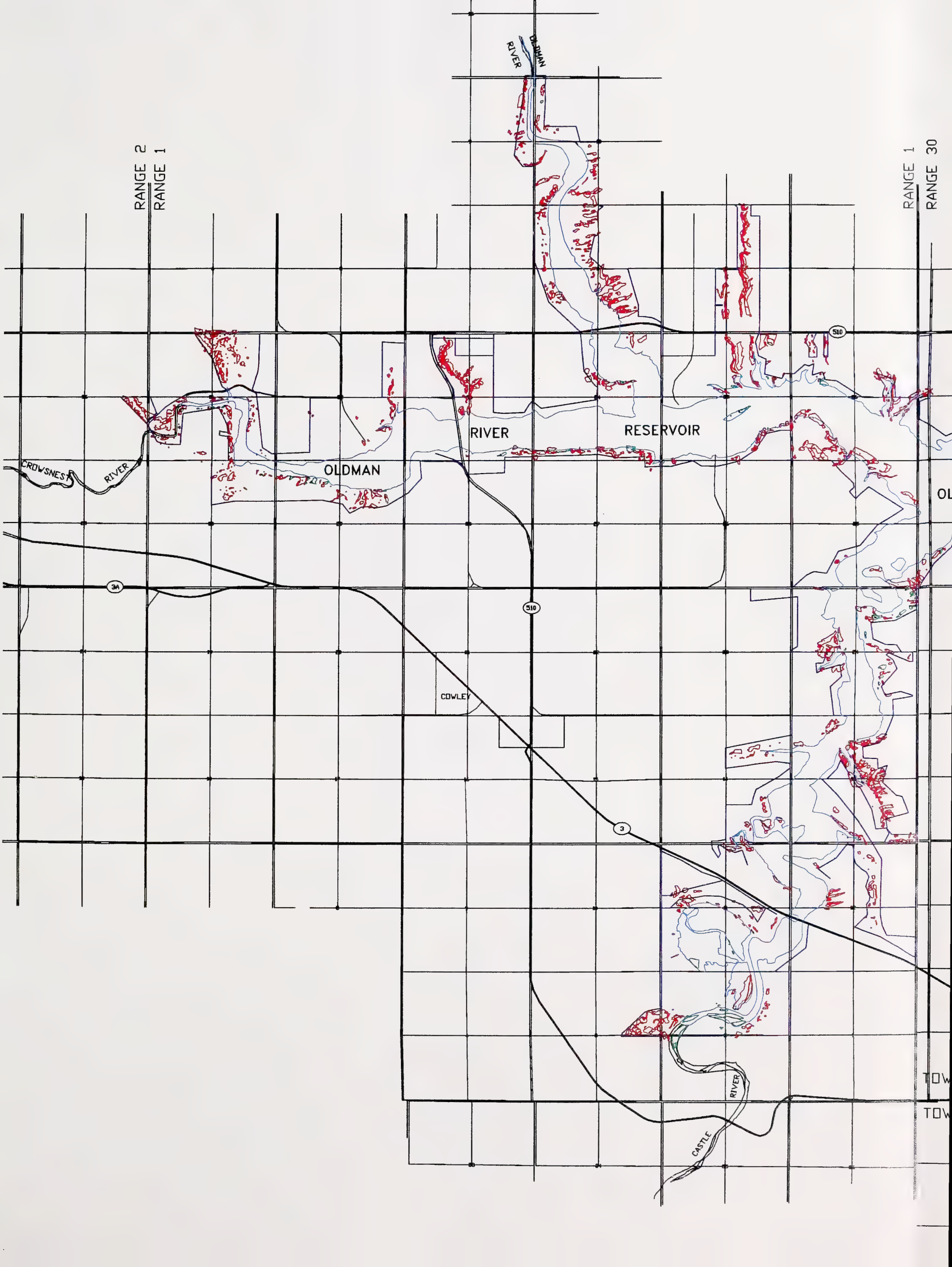
Appendix D - Figure 1
Oldman River Dam Project
Old Tree and Shrub Vegetation





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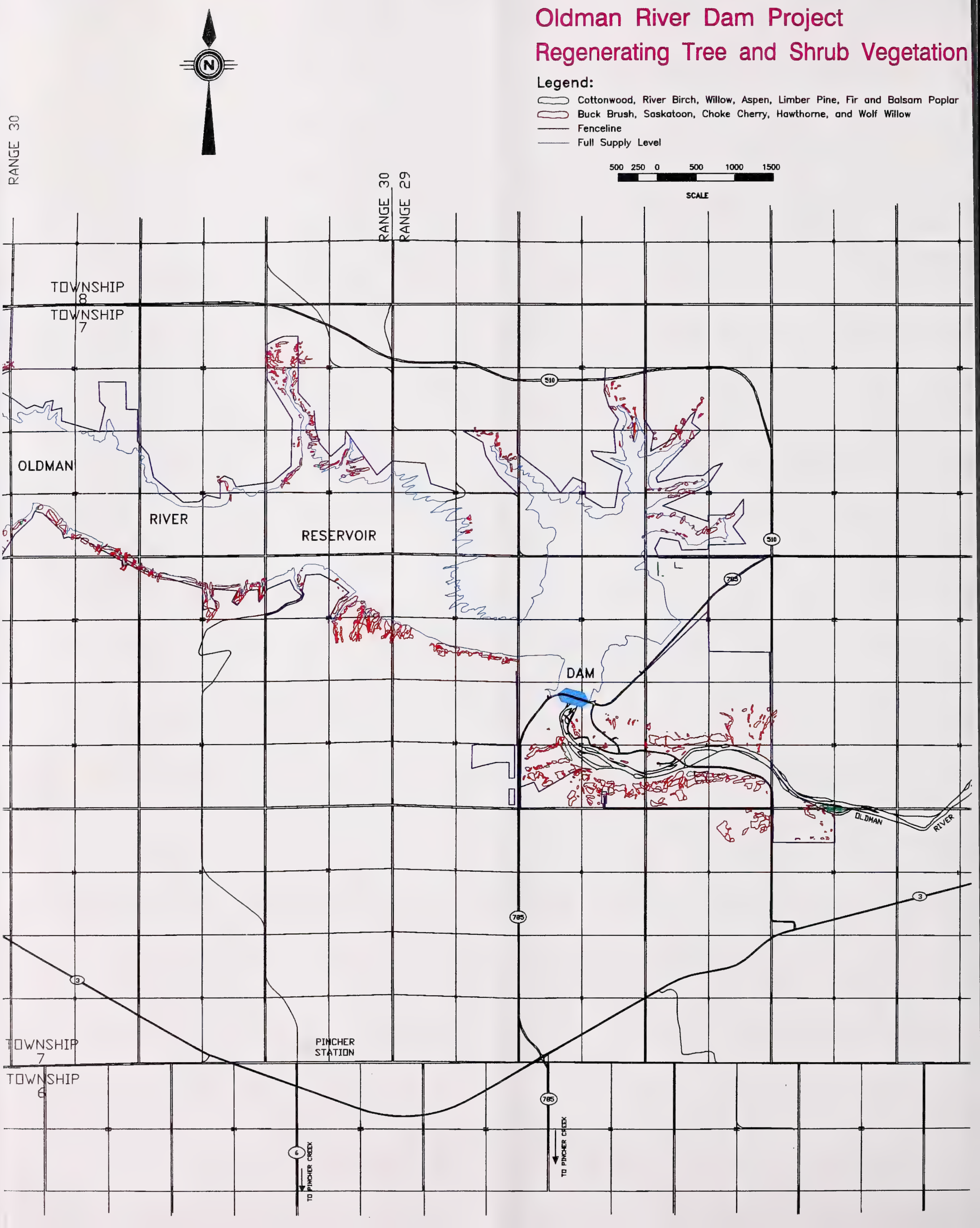
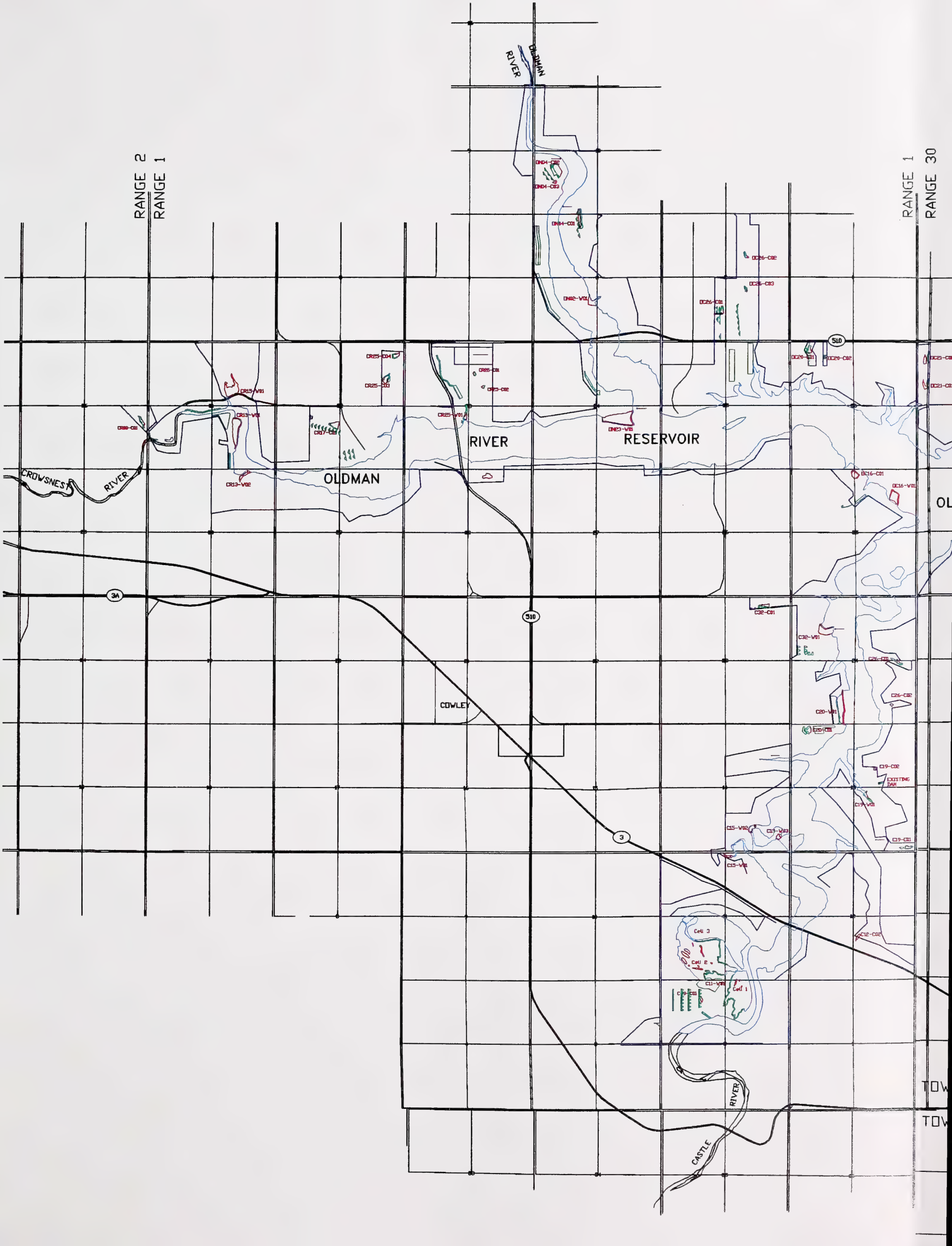
Appendix D - Figure 2
Oldman River Dam Project
Regenerating Tree and Shrub Vegetation

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DC26-C03
DC26-C01
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DC20-C01
DC20-C02
DC21-C0
DC21-C0
CR25-C04
CR25-C03
CR25-C01
CR25-C02
CR15-V01
CR13-V01
CR08-C01
CR17-C01
CR25-V01
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RIVER
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OLDMAN
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RESERVOIR
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C32-V01
C26-C01
C26-C02
C20-V01
C20-C01
COWLEY
C19-C02
EXISTING
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C15-V02
C19-V03
C19-C01
3
C15-V01
Cell 3
C12-C02
Cell 2
C11-V01
Cell 1
C10-C01
TOW
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Appendix D - Figure 3
Oldman River Dam Project
Planted Tree and Shrub Vegetation

Legend:

- ⬭ Planted Vegetation
- ⬭ Wetlands
- — Fenceline
- — Full Supply Level

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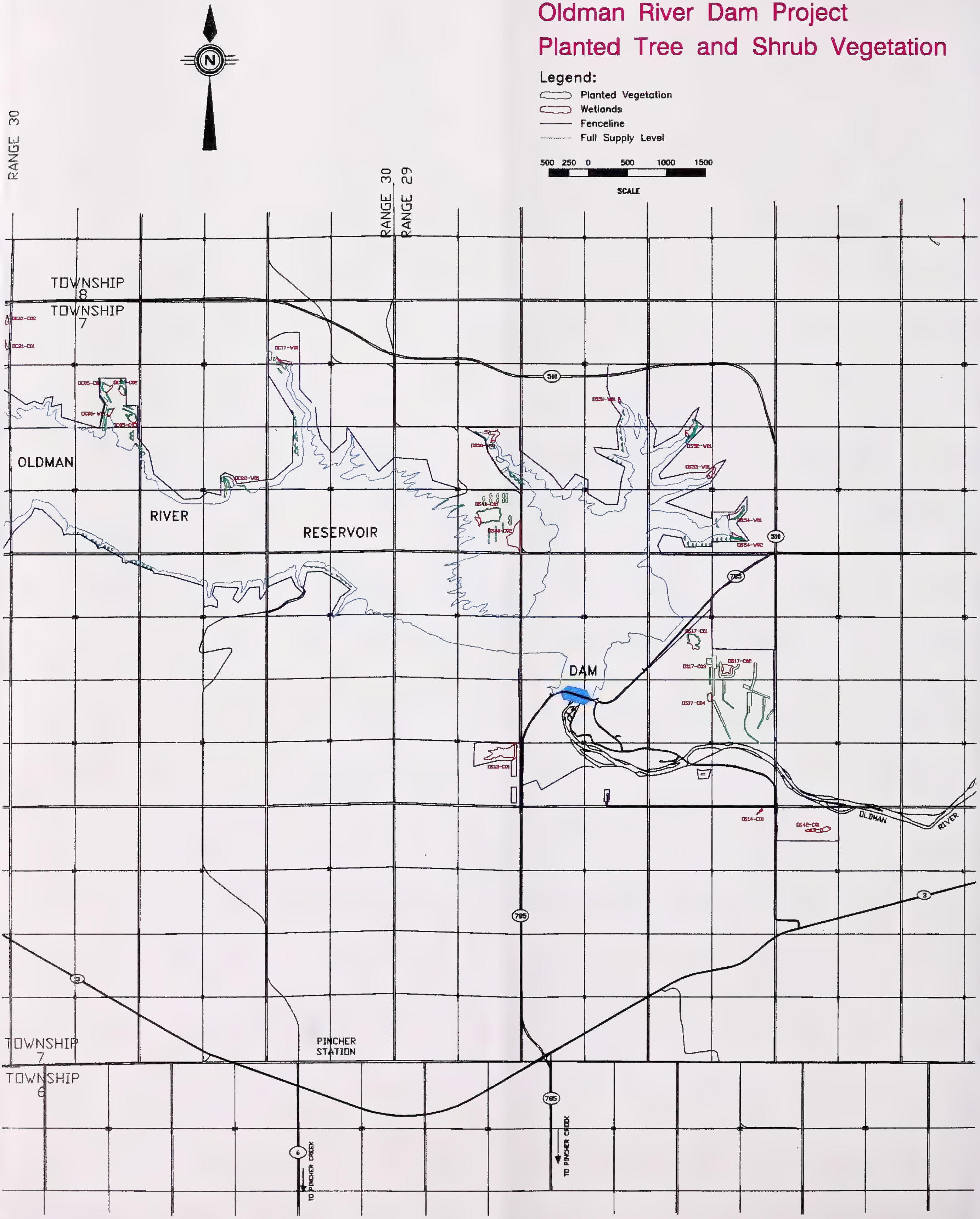

APPENDIX E

GRAZING MANAGEMENT PLAN

OLDMAN RIVER DAM
GRAZING MANAGEMENT PLAN

Al Nilson, P.Eng.
Alberta Public Works, Supply and Services

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I. INTRODUCTION

> *"A range management plan will define the integrated use of grasslands by wildlife and cattle in order to maintain rangelands at an optimum condition for grassland and shrub associated wildlife (Greene, 1992)."*

This plan has been prepared by Alberta Public Works, Supply and Services on the advice of the Local Advisory Committee.

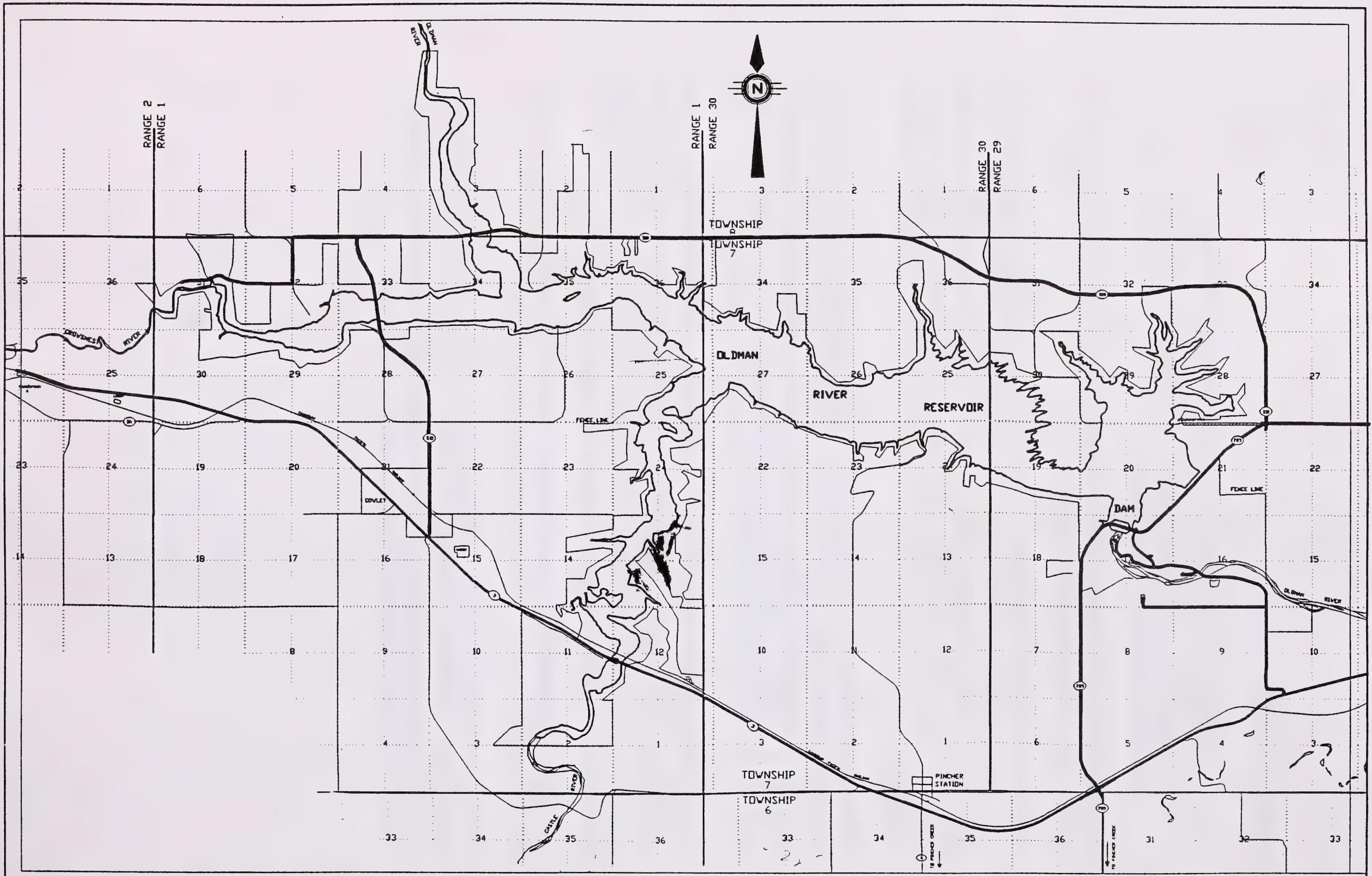
The land acquired for the Oldman River Dam Project which is not flooded by the reservoir forms a land base of 2500 ha. This land is the primary resource used for the Wildlife Mitigation Program (Nilson & Greene, 1989). A substantial component of that program is the reestablishment of shrub and tree communities. Much of the land base is not suitable for the shrub development. It will remain grassland indefinitely.

Greene, 1992 states that the grassland should be maintained in optimum condition for grassland and shrub associated wildlife. Greene, 1992 also lists the wildlife species associated with the grassland guild which is represented by the Western Meadowlark. Eastern Slopes Rangeland Consultants Ltd., 1992 outlines grazing practices that will maintain the optimum condition of the grassland.

These grazing recommendations along with fencing, adjacent land use, water availability, recreation use of project lands and legal constraints were then considered by the Grazing Subcommittee of the Local Advisory Committee to determine an appropriate strategy for the use of project lands. This report presents the recommendations for agricultural use of the project lands.

The report is separated into specific parcels of land. The recommended uses are provided for each parcel. A map outline the parcel follows.

This report outlines the areas where grazing is permitted, stocking capacities, recommended rotational strategies, watering sources, areas where haying is permitted, scheduling of haying operations, areas where cultivation is permitted, and pesticide and herbicide restrictions within the land base.



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The following requirements are common to all parcels within the land base:

1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.

SECTION 1 - GRAZING LEASES

Area GR1

Location: NW10-7-29-4

Size: 26.5 ha

Capacity: 52 AUM/yr

History: This area was a borrow pit during construction. It was graded, topsoiled and seeded to permanent grass cover in 1990. Four wetlands were left from construction.

When: The area should be grazed between June 15 and August 15. If the area is to be hayed, haying should be restricted to July 15 to August 15. Haying and grazing should not be carried out in the same year.

Fence:
South - Fenced
West - Fenced
North - River, crossfence needed west end
East - Crossfence needed
- Fence needed around wetlands

Water: Cattle can be watered in the west wetland.

Recommended Lessee: Mr. Maloff

Conditions:

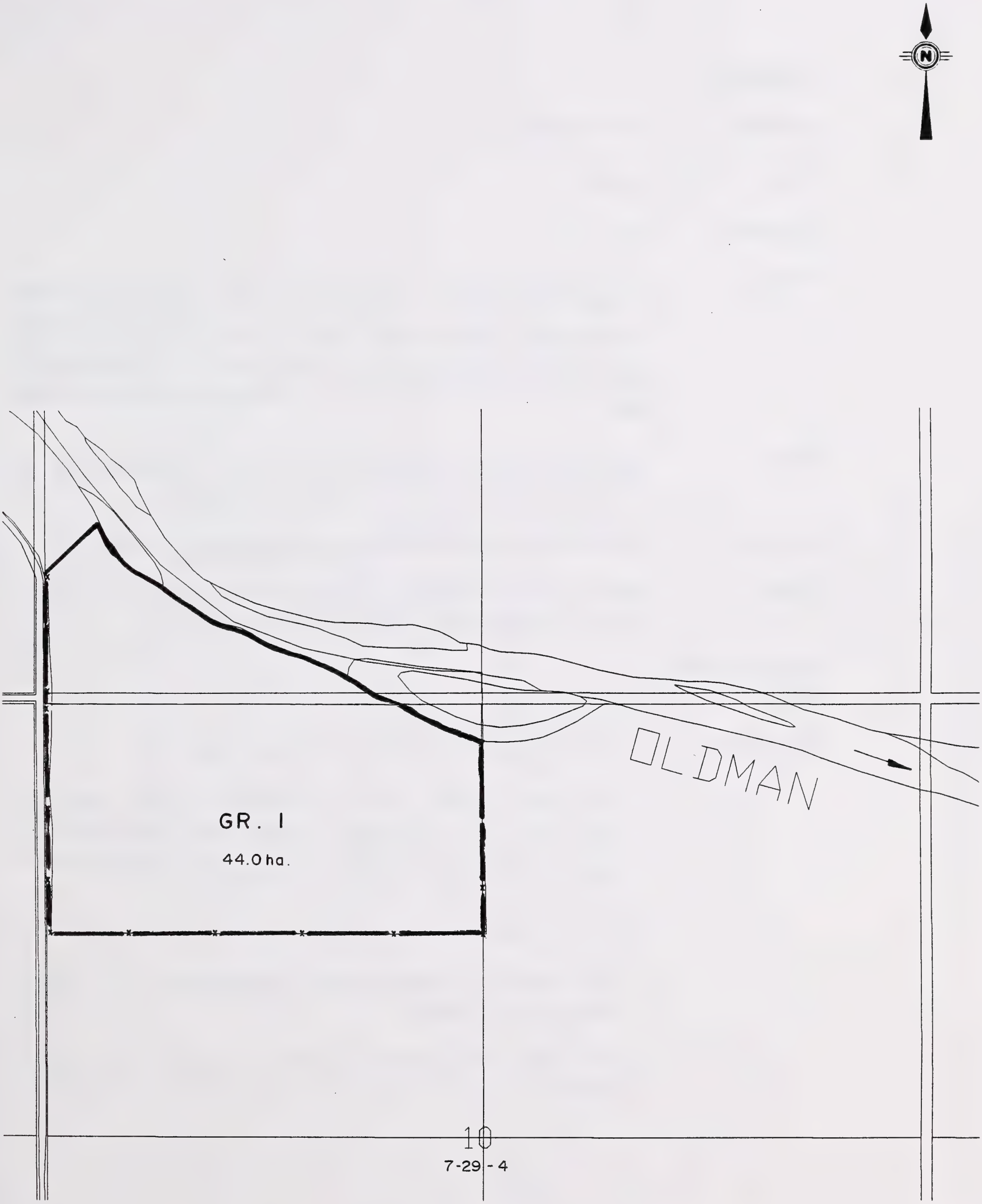
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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Area GR2

Location: NW16-7-29-4

Size: 23.5 ha

Capacity: 46 AUM

History: This area was reseeded to permanent grass cover after it eroded in 1986. The area is adjacent to an area that contains five wetlands and 50,000 planted trees. Grazing or haying can be permitted on the lands west of the wetlands. A buffer of 75 meters should be left between the wetlands and any agricultural use.

When: Haying should be undertaken between July 15 and August 15 or grazing could occur from June 15 to August 15.

Fences: The area has no fences that can be used as borders.

Water: Cattle can be watered at the south end of the parcel. A waterline through this area can be extended to a water tank.

Recommended Lease: Mr. Fairbrother

Conditions:

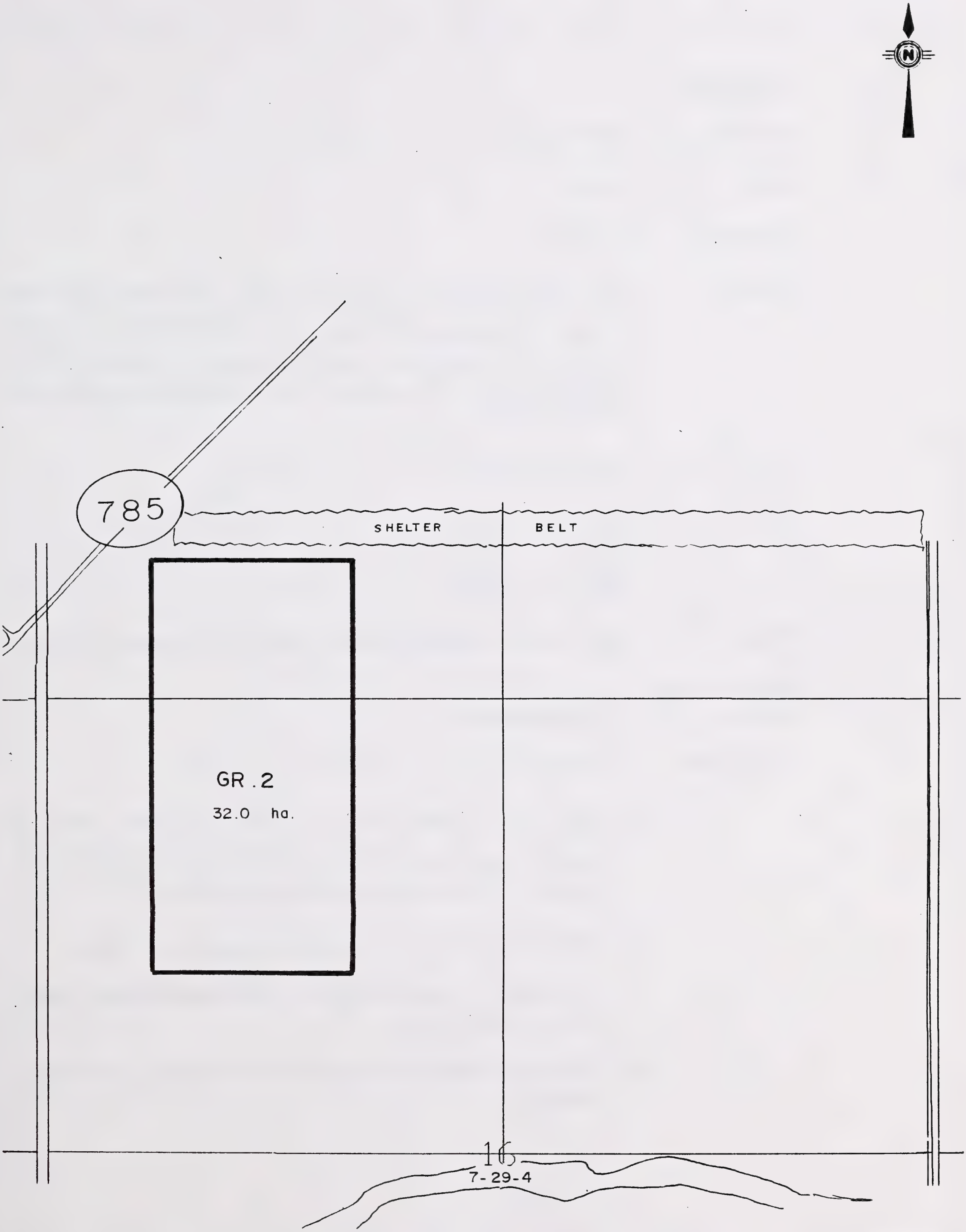
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR 3

Location: SW17-7-29-4

Size: 27.8 ha

Capacity: 21 AUM/yr

History: This area includes a waste area from construction that was graded, topsoiled and seeded to a permanent cover. The area contains two coulees with mature fir cover on the north facing slopes. The uplands are native grasslands. Grazing can be permitted on the entire parcel. Grazing should be rotated with adjacent parcels.

When: June 15 to Aug. 15

Fences:
East - fenced
West - fenced
North - fenced
South - fenced

Water: Cattle can be watered at the east end in a dugout near the river.

Recommended Lessee: Mr. Higginbotham

Conditions:

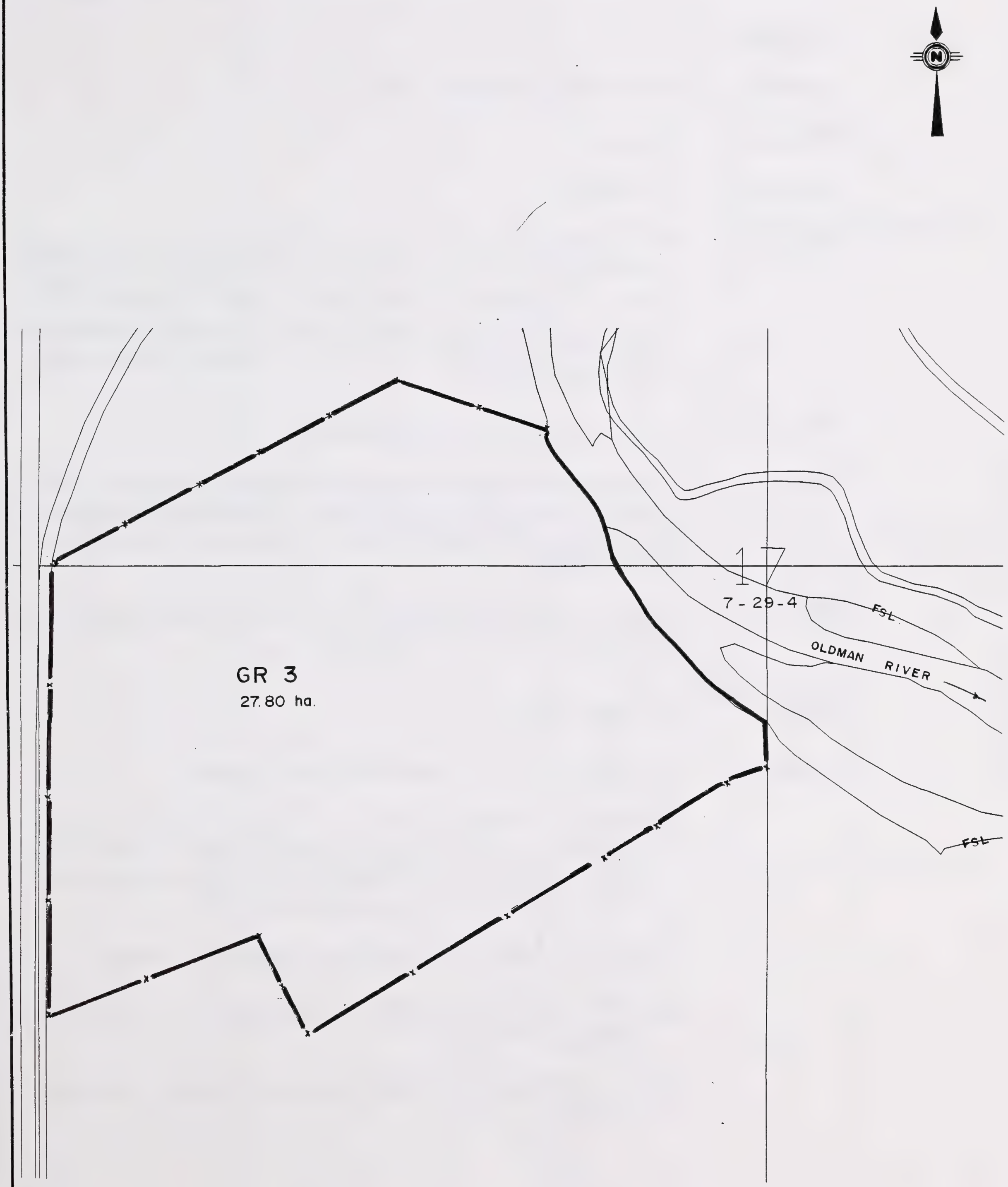
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR4

Location: S½19-7-29-4 and SE24-7-30-4

Size: 70.5 ha

Capacity: 43 AUM/yr

History: The east end of this area was used for storage during construction. It was graded, topsoiled, ad seeded to permanent cover. The balance of the parcel is native grassland with a mature fir forest along the north edge. The reservoir bounds the parcel along the north and east sides. Grazing should be rotated with adjacent parcels.

When: June 15 to Aug. 15 when reservoir full.

Fences: A fence does not exist along the south edge of the parcel. This parcel can be grazed in conjunction with private land adjacent to the parcel. Earl Higginbotham is the current landowner of adjacent lands.

Water: Cattle are watered in dugouts on Earl's land or in the reservoir at the east or west ends of the parcel.

Recommended Lessee: Mr. Higginbotham

Conditions:

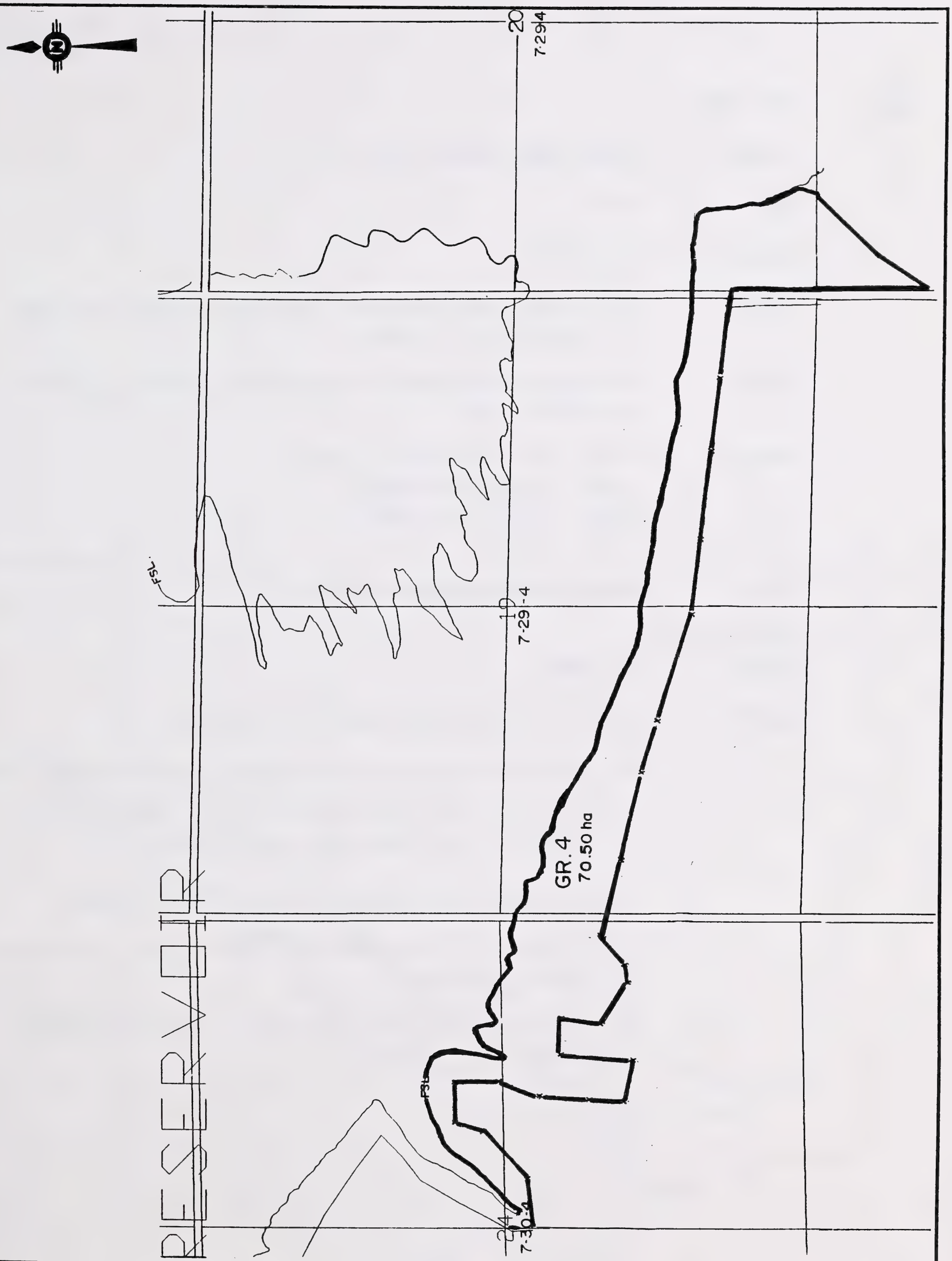
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR5

Location: N½29, SE32, NE30-7-29-4

Size: 58 ha

Capacity: 57 AUM/yr

History: This area is native grassland. It contains wetlands at the north and west ends of the parcel.

When: Grazing should be rotated between June 15 and August 15 when the reservoir is full.

Fences:
North - Fenced crossfence needed
West - Crossfence needed
East - Crossfence needed
South - Reservoir

Water: Water is available in the reservoir.

Recommended Lessee: Mr. Lewis

Conditions:

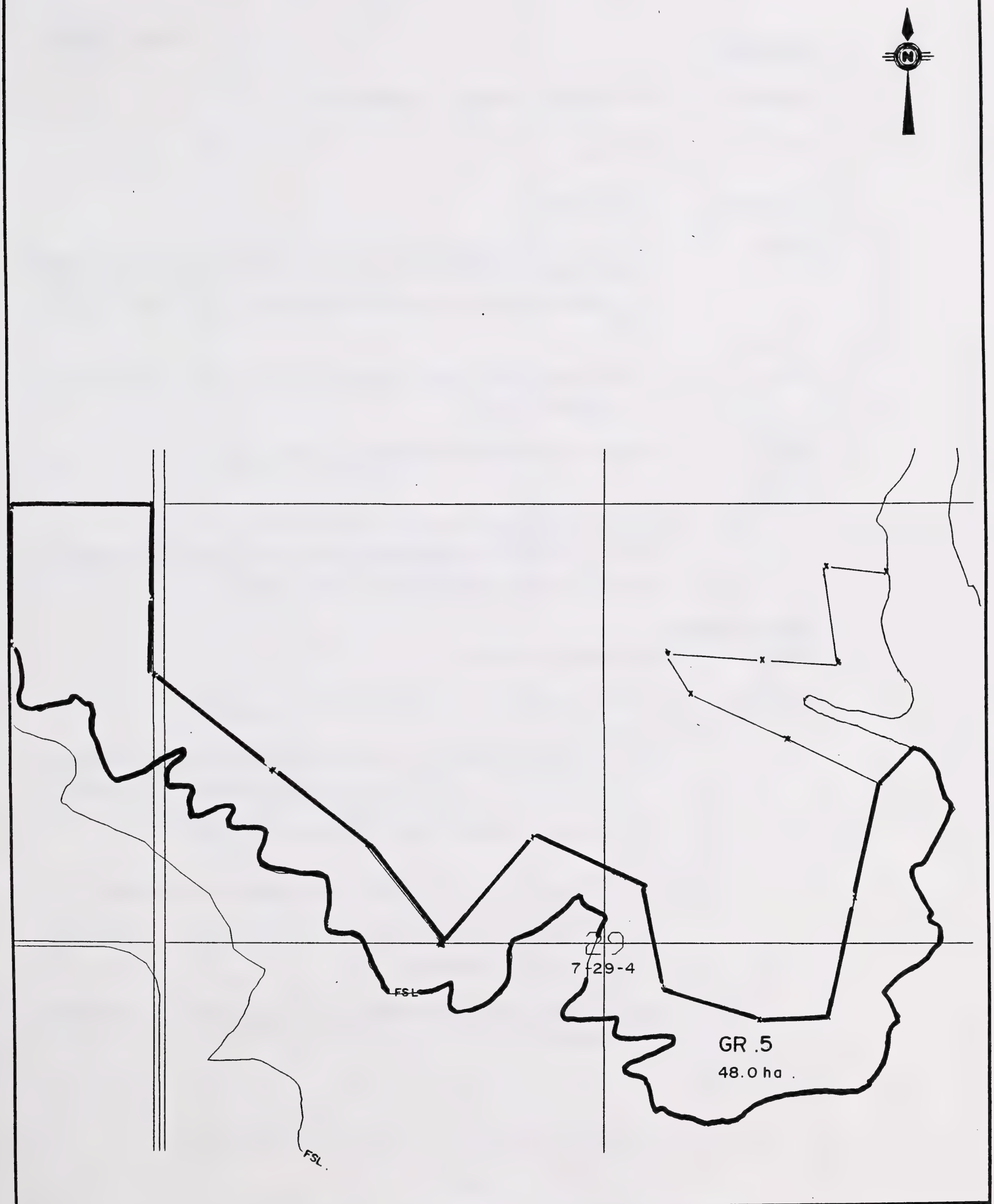
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR6

Location: N½30-7-29-4, SE36, and NE25-7-29-4

Area: 50.5 ha

Capacity: 50 AUM/year

History: This area is native grassland. It extends from the Bitango Bridge to the north end of Tennessee Coulee. The parcel is bounded by the reservoir along the south side and the project fence along the north.

When: Grazing should be rotated between June 15 and August 15 when the reservoir is full.

Water: Cattle can be watered directly out of the reservoir.

Fencing: North - Fenced
South - Reservoir
Fencing will have to be installed and maintained along the Bitango road and along the north end of the parcel.

Recommended Lessee: No interest expressed

Conditions:

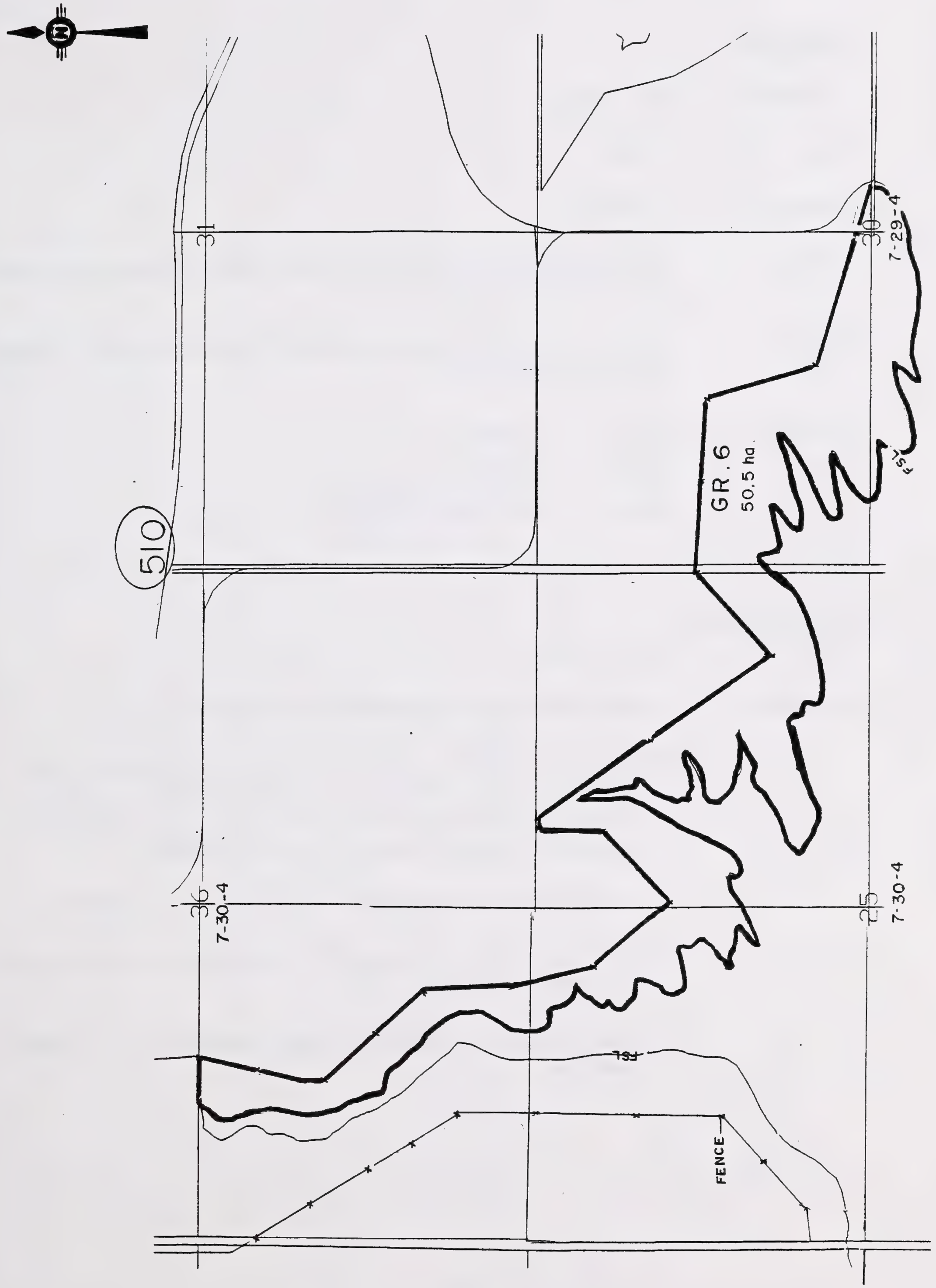
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR7

Location:	SW27-30-4
Size:	8.3 ha
Capacity:	9 AUM/yr
History:	Native grassland. Historical in rotation with adjacent parcel which is owned by Mr. Robbins
When:	Rotate with adjacent grassland (SW27-30-7-4) June 15 - August 15 when reservoir full.
Fencing:	North - reservoir South - Fenced East - Crossfence needed West - Crossfence needed
Water:	From reservoir
Recommended Lessee:	Mr. Robbins

Conditions:

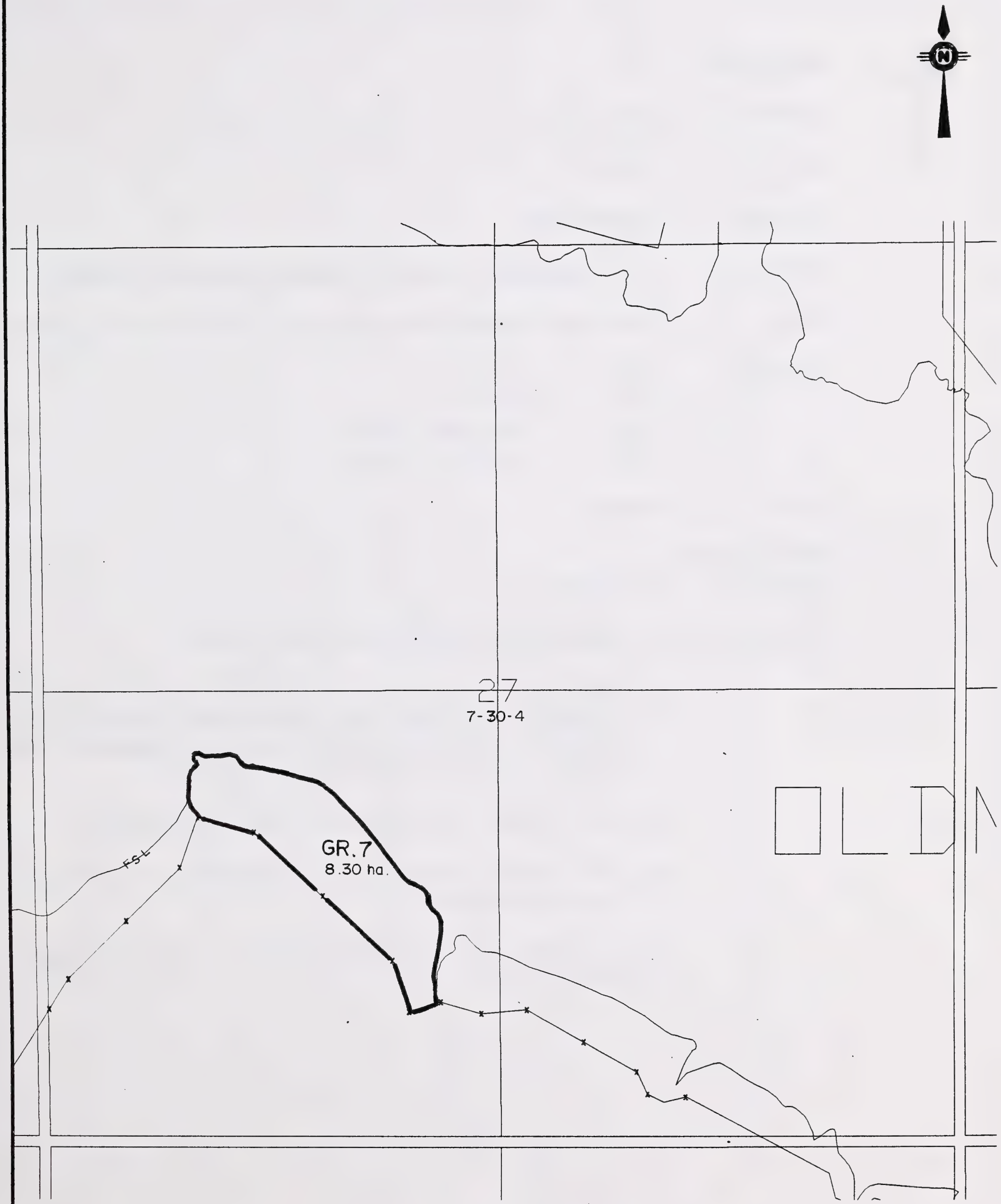
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR8

Location: E24-7-1-5

Size: 20.1 ha

Capacity: 35 AUM/year

History: Native grassland. Historically grazed with adjacent grassland.

When: Rotate with adjacent grassland (E24-30-7-4) June 15 - August 15

Fencing:
West - reservoir
East - fenced
South - crossfence needed
North - crossfence needed

Water: reservoir

Recommended Lessee: Mr. Robbins

Conditions:

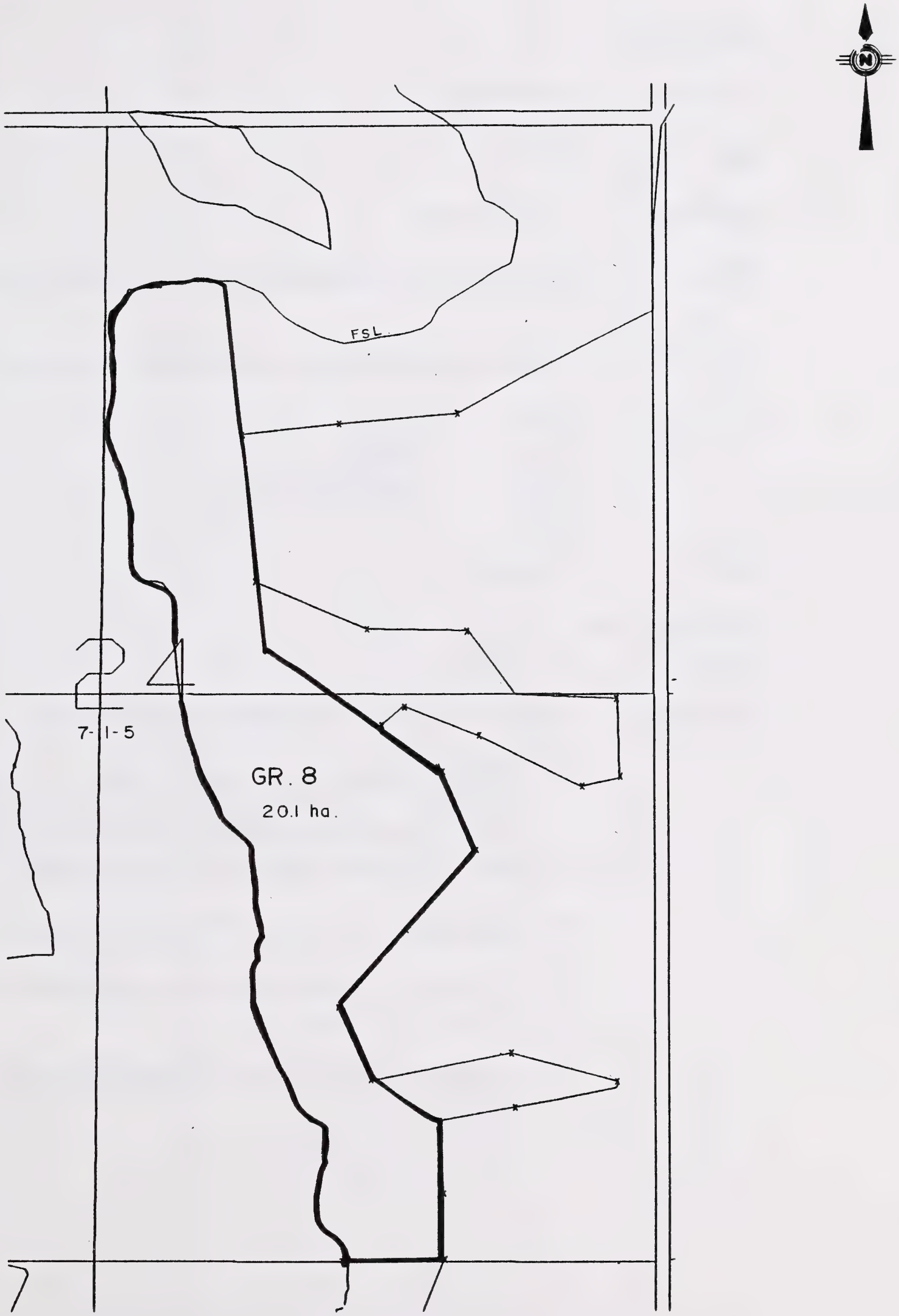
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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GR 8

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AREA GR9

Location: NW36-1-7-5

Size: 14.80 ha

Capacity: 11 AUM/year

History: Native grassland historically grazed with adjacent pasture in N36-1-7-5.

When: Rotate with adjacent grassland (NW36-1-7-5) June 15 - August 15

Fencing:
North - Fenced
South - reservoir
East - Crossfence required
West - Crossfence required

Water: Reservoir

Recommended Lessee: Mr. Lang

Conditions:

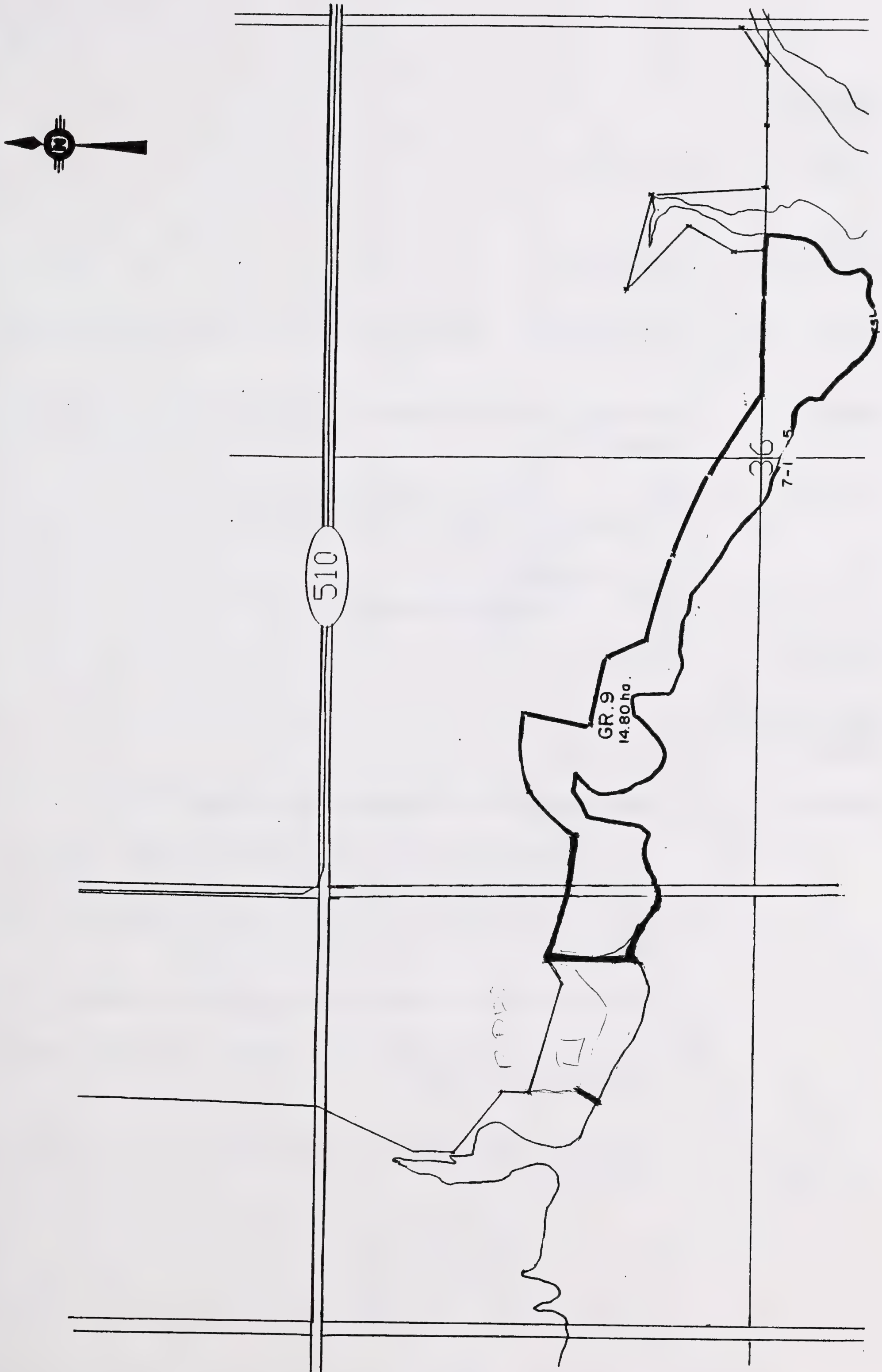
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR10

Location: SE13-7-1-5

Size: 22.1 ha

Capacity: 19 AUM/year

History: Native grassland. Historically grazed with adjacent pasture in SE13-7-1-5.

When: Rotate with adjacent grassland when reservoir full from June 15 to August 15.

Fencing:
West - reservoir on northwest side
Crossfence required southwest side
South - fenced
East - fenced
North - Crossfence required

Water: from reservoir

Recommended Lessee: Mr. Robbins

Conditions:

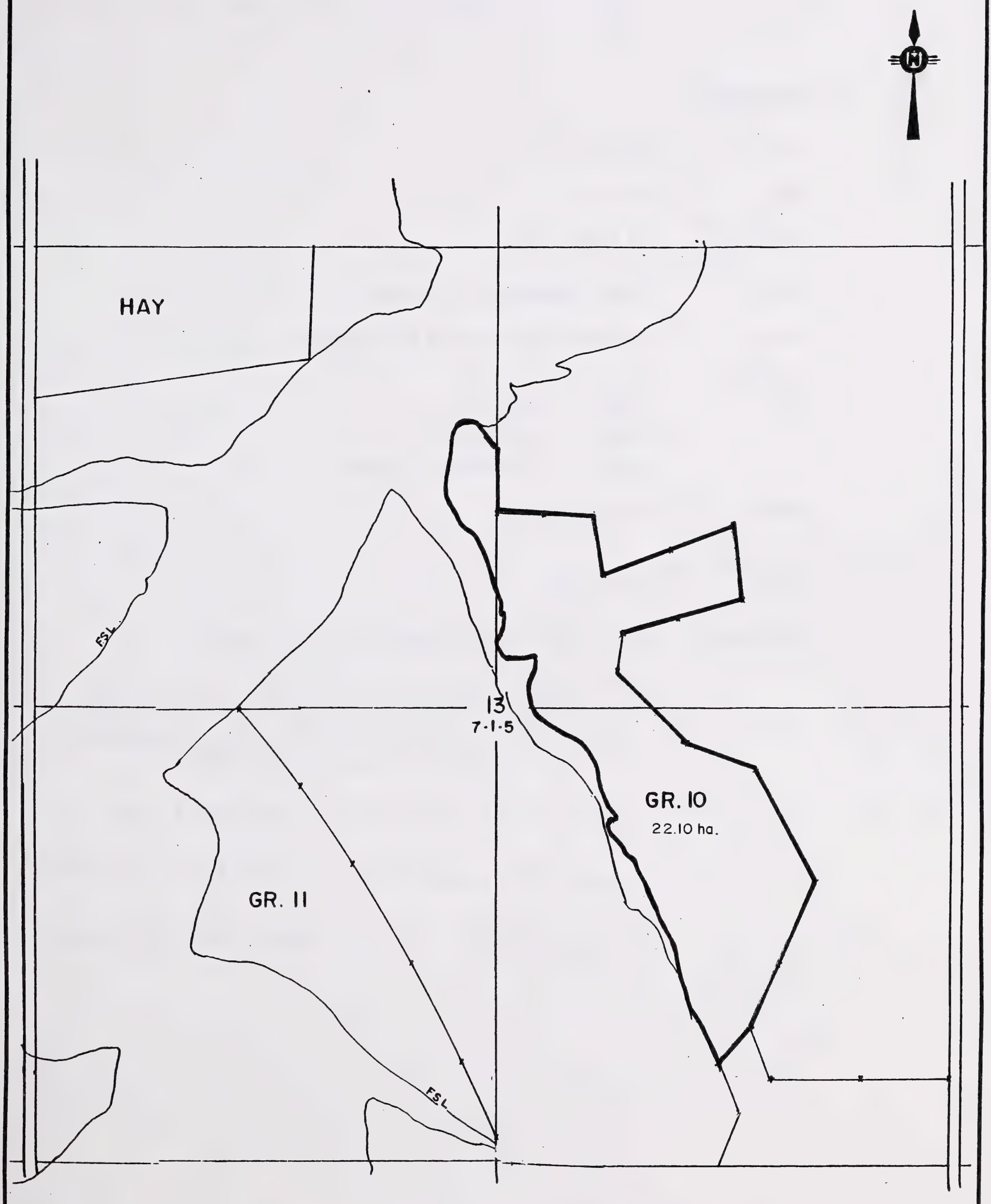
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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PROJECT OLDMAN RIVER DAM
TITLE GRAZING MANAGEMENT PLAN
GR. 10
DATE JAN. 1993
SHEET 1 OF 1
PAGE No. 23
REV.

AREA GR11

Location: SW13-7-1-5

Size: 18.5 ha

Capacity: 18 AUM/year

History: Native grassland. CPR. ROW.

When: rotate with lands in S13-7-1-5 June 15 - August 15

Fencing:
East - Fenced
North - Reservoir
West - Reservoir
South - Crossfence required

Water: from reservoir

Recommended Lessee: Mr. Voglaar

Conditions:

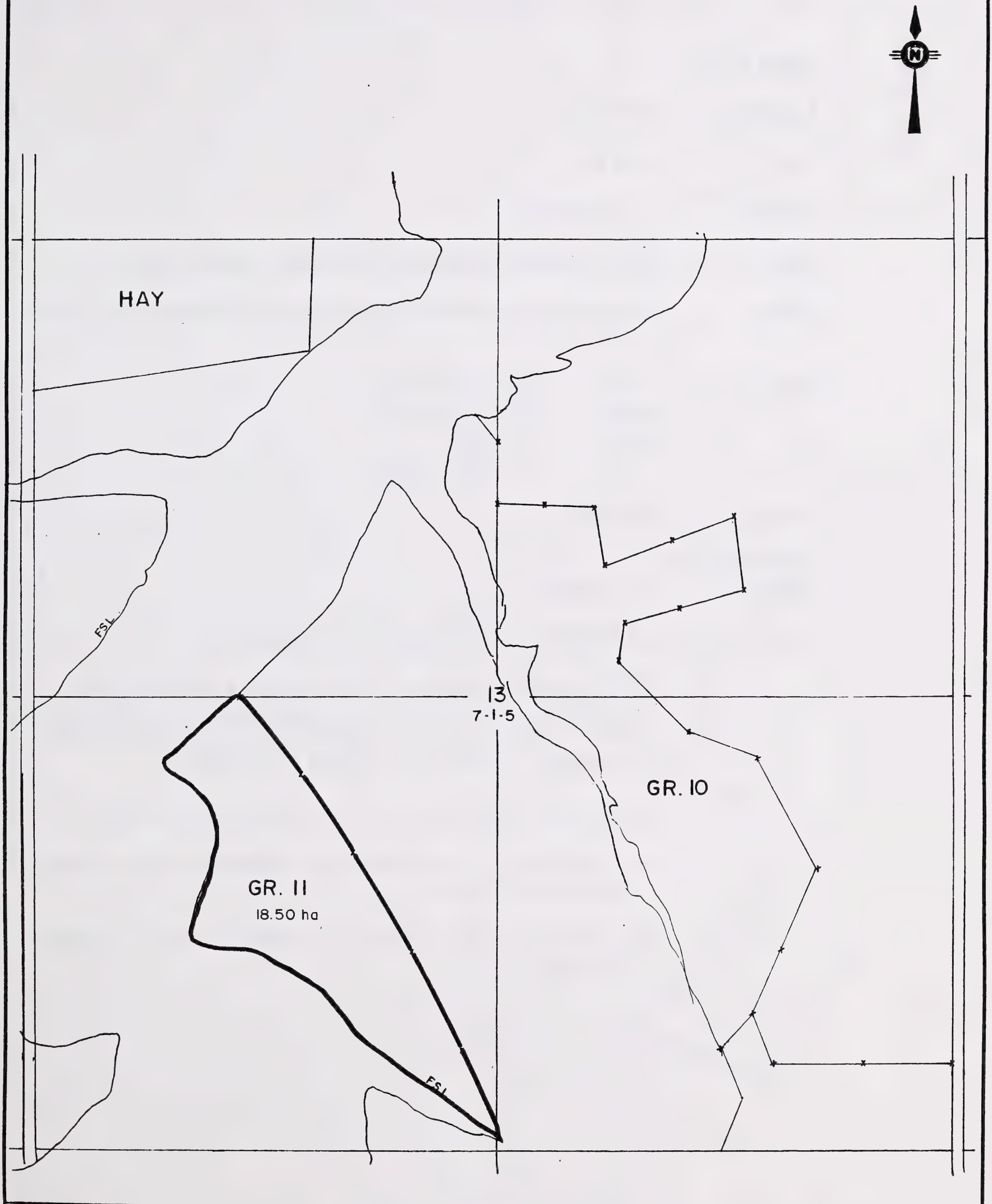
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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DRAWN BY: W.KNOL

CHECKED BY: D.WILSON

SCALE: N.T.S.

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PROJECT: OLDMAN RIVER DAM

TITLE: GRAZING MANAGEMENT PLAN
GR. 11

DATE: JAN. 1993

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AREA GR12

Location: NW12-7-1-5

Size: 11.3 ha

Capacity: 11 AUM/year

History: Native grassland historically grazed with adjacent pasture.

When: Graze in conjunction with adjacent pasture in NW12-7-1-5. June 15 - Aug. 15.

Fencing:
North - Short crossfence
South - Bridge abutment
West - Reservoir
East - no fence required

Water: Reservoir

Recommended Lessee: Mr. Vogelaar

Conditions:

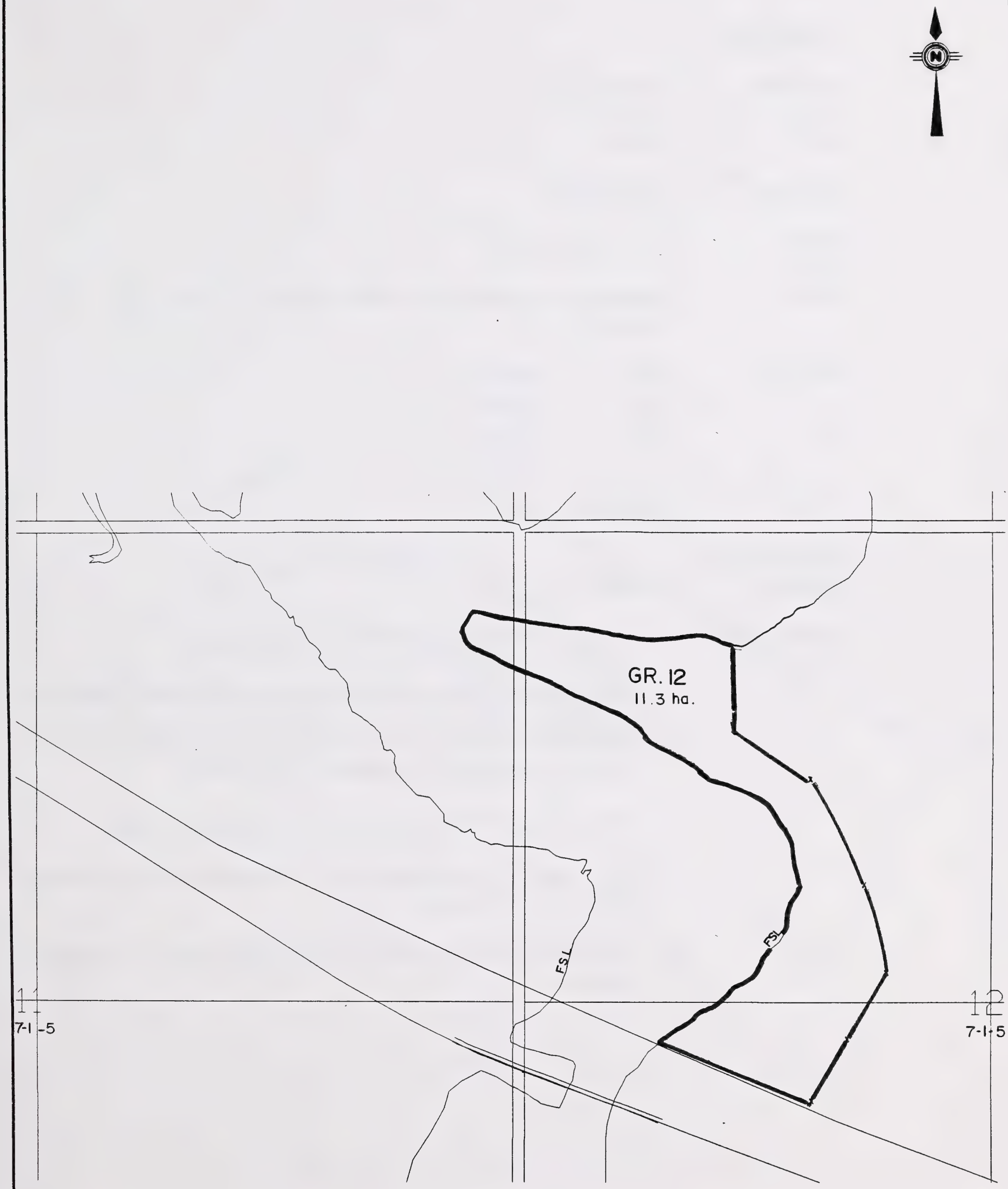
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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TITLE GRAZING MANAGEMENT PLAN
GR.12

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AREA GR13

Location: N½-11-7-1-5

Size: 25.5 ha

Capacity: 28 AUM/year

History: Old seeded pasture

When: Rotate with adjacent grassland NE10-7-1-5 from June 15 to August 15.

Fencing:
East - reservoir
West - fenced
North - fenced
South - fenced

Water: Reservoir

Recommended Lessee: Mr. Gray

Conditions:

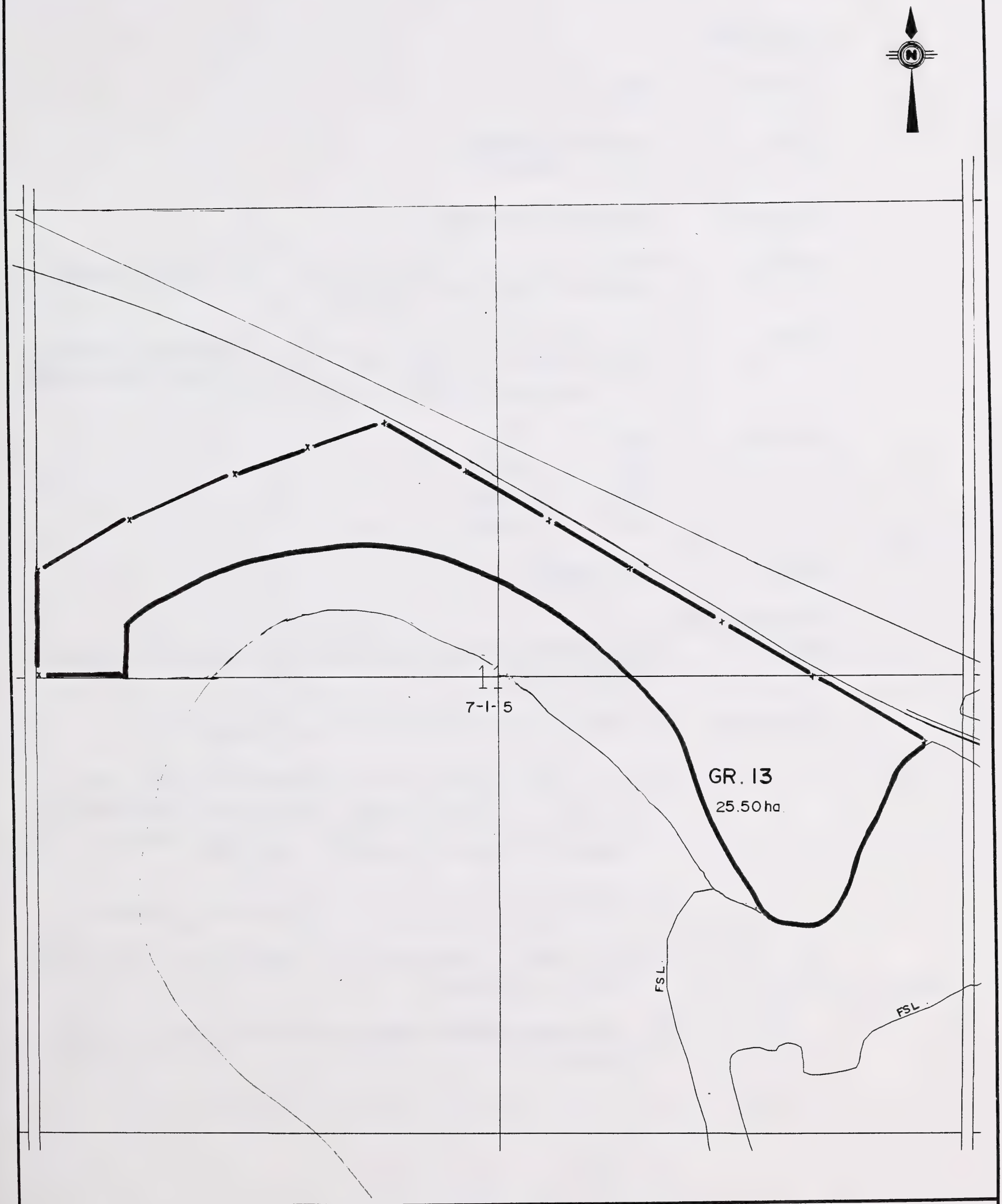
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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TITLE GRAZING MANAGEMENT PLAN
GR. 13

DATE JAN. 1993 SHEET 1 OF 1 PAGE No. 29 REV.

AREA GR14

Location: NE2-7-1-5

Size: 6.4 ha hay/grazing
11.5 ha cultivation

Capacity: Grazing 13 AUM/year

History: This area is former cultivated land. Future farming practice should not change from historical.

When: Hay should be cut July 15 to August 15/Alternately could be grazed June 15 to August 15. Cultivation should continue with 25% of crop left standing for water fowl bait.

Fencing:
West - fenced
East - fenced
North - fenced
South - fenced

Water: None available

Recommended Lessee: Billy Robinson (former landowner SE11-7-1-5) has expressed interest in parcel.

Conditions:

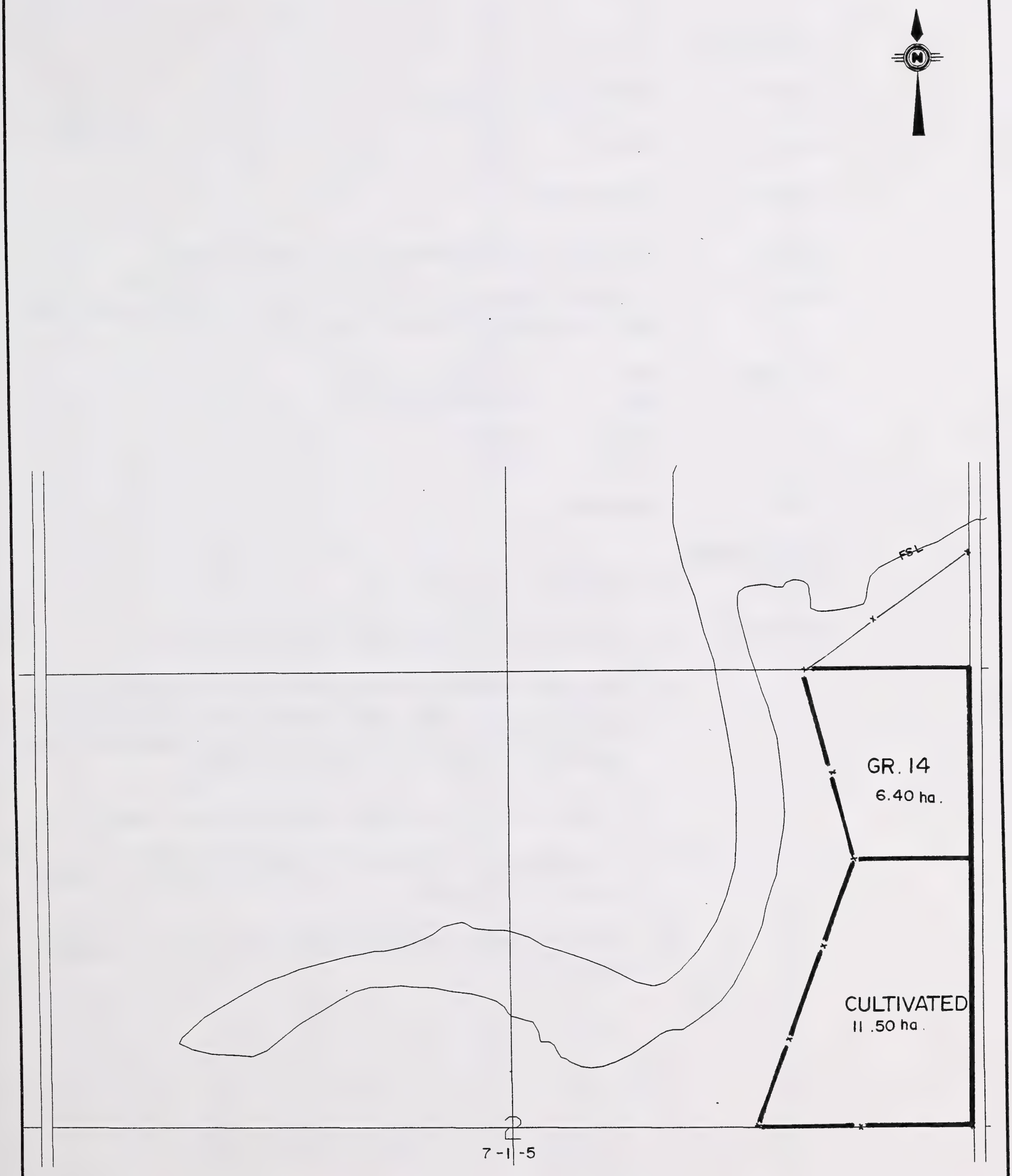
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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TITLE GRAZING MANAGEMENT PLAN
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AREA GR15

Location: SE33, S½34, NW26-7-1-5

Size: 17.7 ha

Capacity: 13 AUM/year

History: This area is native grass amongst mature fir trees.

When: In rotation with adjacent pasture along the south fenceline from June 15 to August 15 when reservoir full.

Fencing:
West - Crossfence required
East - Crossfence required
North - reservoir
South - fenced

Water: Reservoir

Recommended Lessee: Mr. Smythe

Conditions:

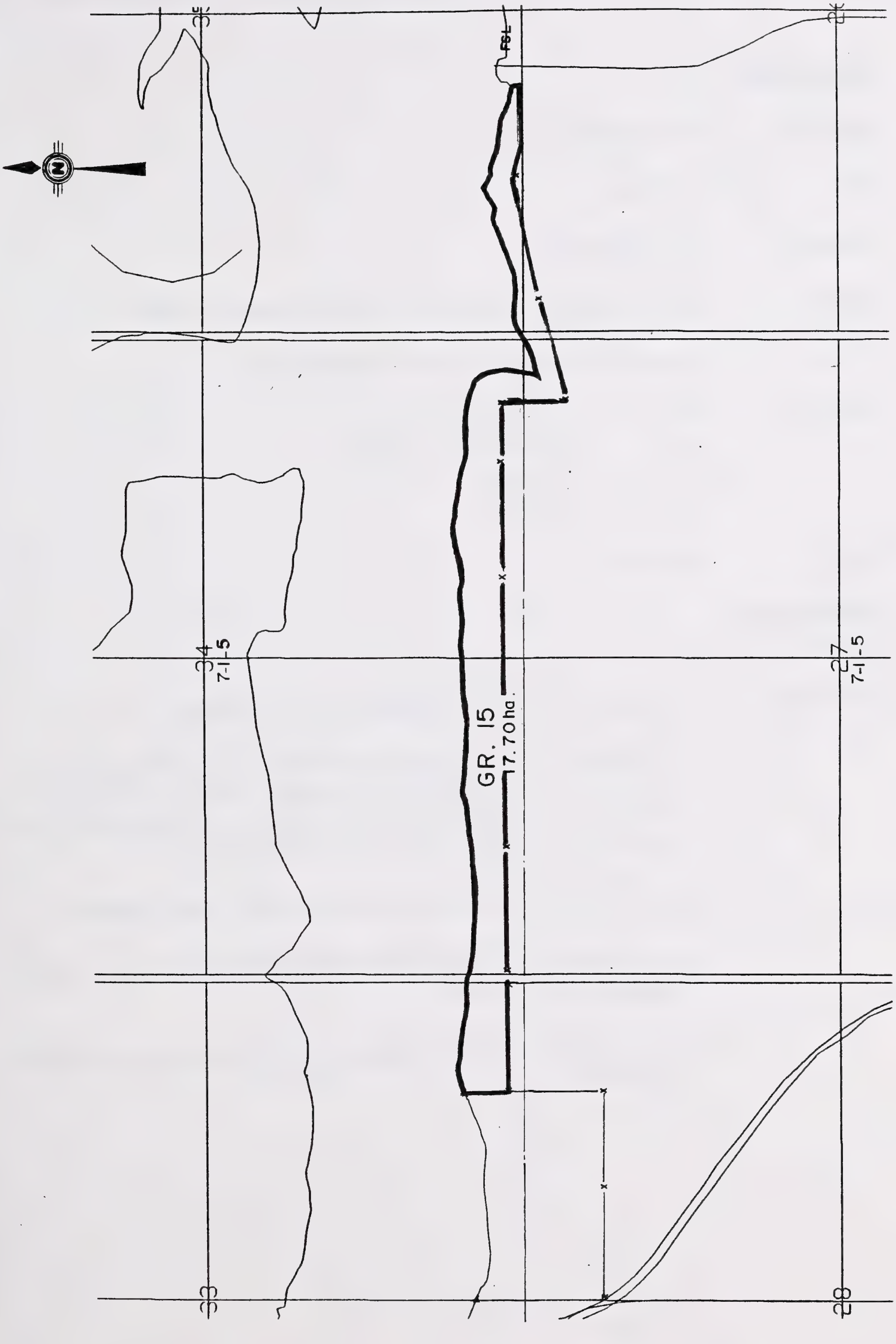
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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TITLE GRAZING MANAGEMENT PLAN
GR. 15
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AREA GR16

Location: E33, SW34-7-1-5

Size: 22.7 ha

Capacity: 20 AUM/year

History: Native pasture historically grazed with valley bottom

When: June 15 to August 15 when reservoir full

Fencing:
West - Crossfence required
East - Crossfence required
North - reservoir
South - fenced

Water: Reservoir

Recommended Lessee:

Conditions:

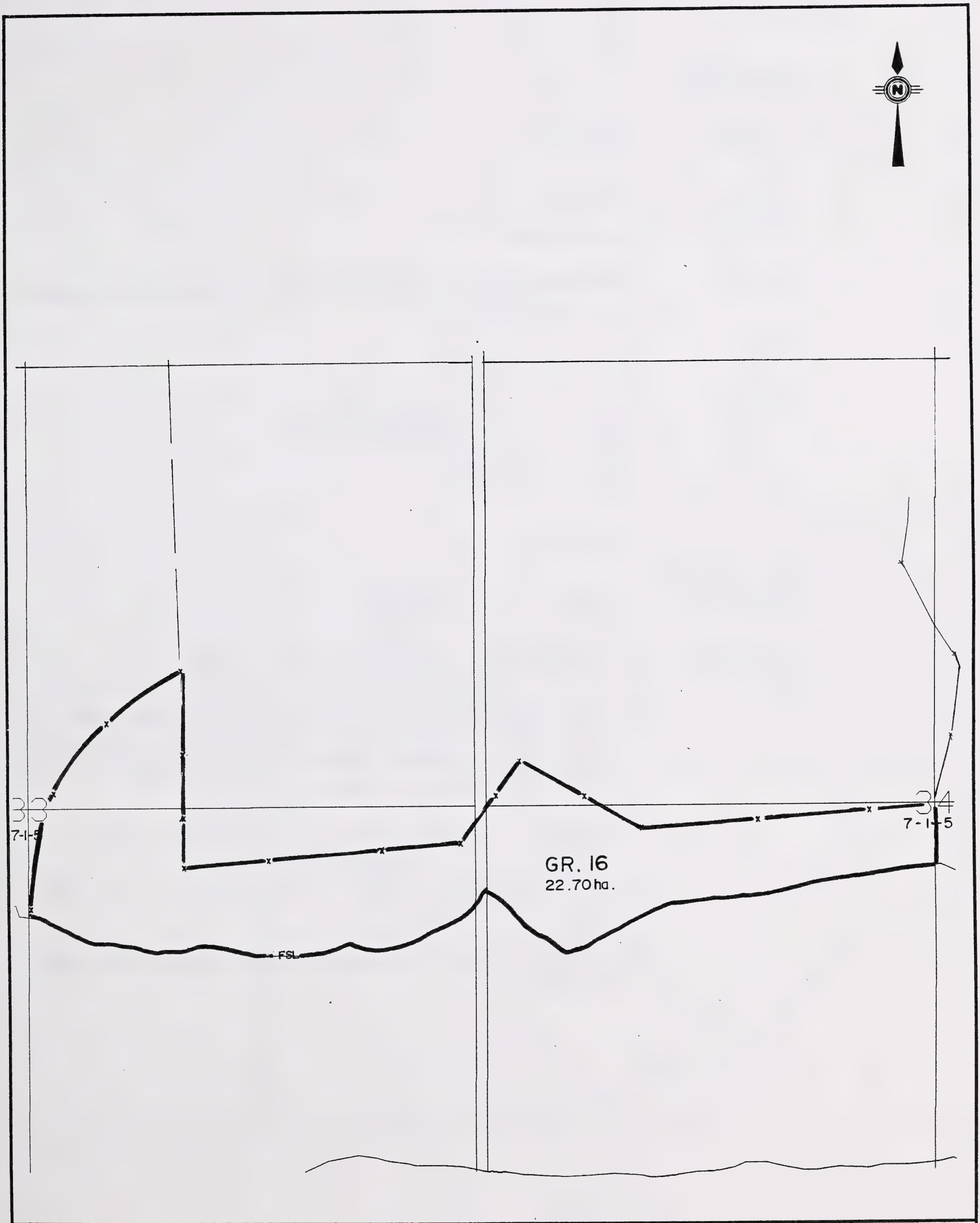
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR17

Location: S32-7-1-5

Size: 59.9 ha

Capacity: 59 AUM/year

History: This area may be develop for wildlife or recreation purposes, once the reservoir fills.

When: June 15 to August 15

Fencing:
West - Crossfence required
East - Some fencing required
North - fenced
South - reservoir

Water: Reservoir

Recommended Lessee: Leased to Mr. Olsen in past

Conditions:

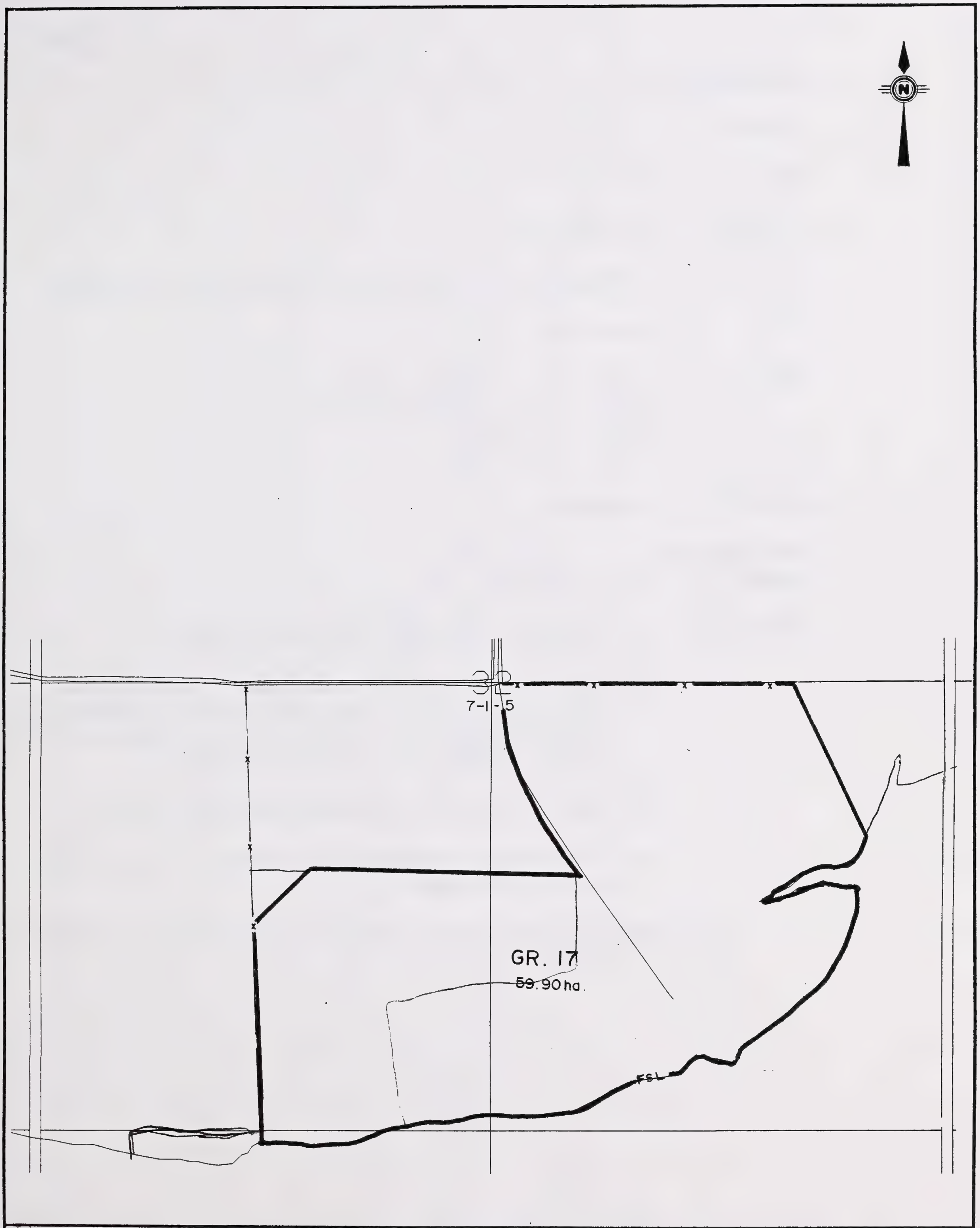
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR18

Location:	N½-29-7-1-5
Size:	23.2 ha
Capacity:	20 AUM/year
History:	This area is native grass amongst mature fir and spruce trees.
When:	June 15 - August 15
Fencing:	West - Crossfence required East - Crossfence required North - reservoir South - fenced
Water:	Reservoir
Recommended Lessee:	None expressed

Conditions:

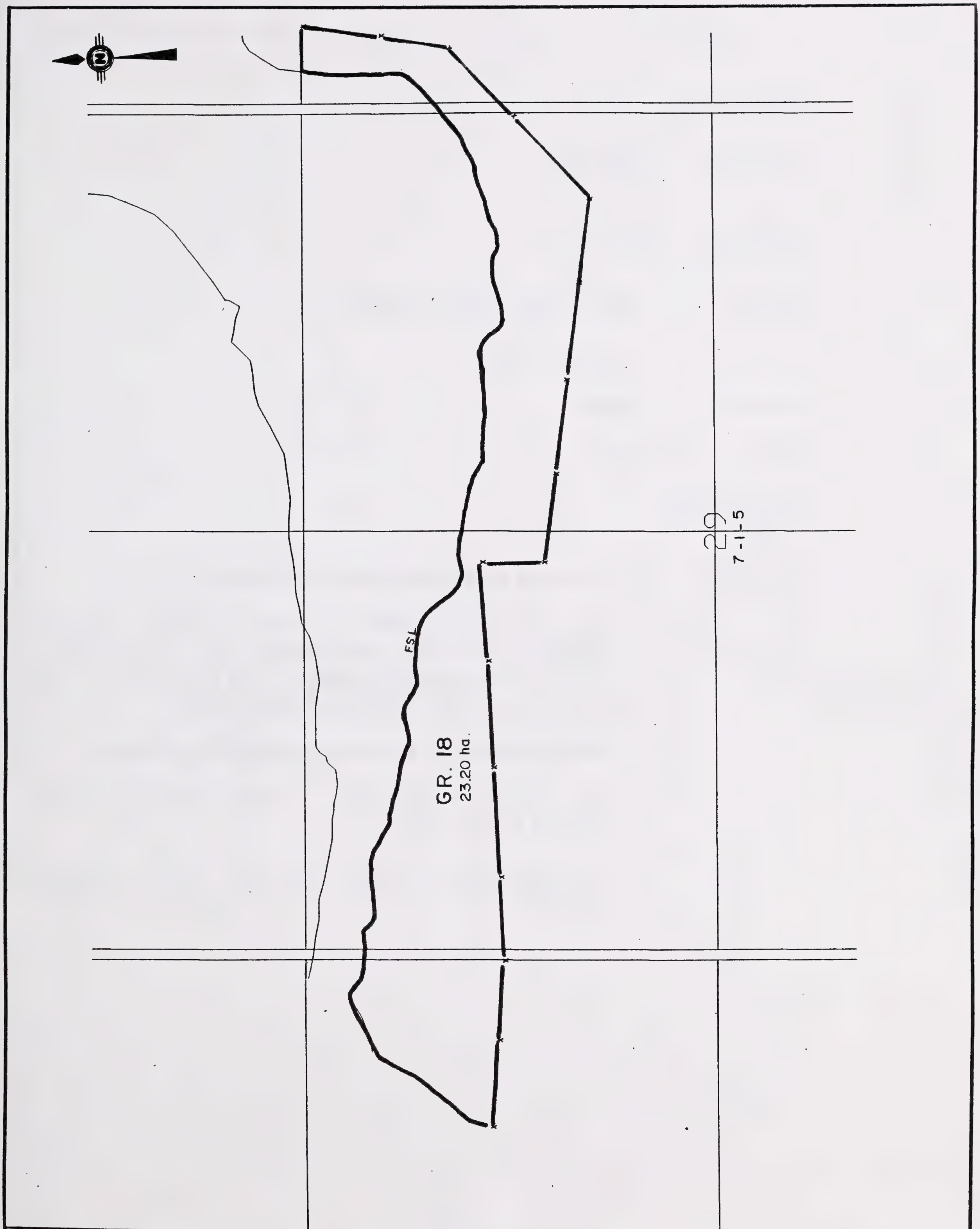
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR19

Location: SW31-7-1-5

Size: 8.3 ha

Capacity: 8 AUM/yr

History: Valley bottom, contains shrubs.

When: June 15 - August 15

Fencing: Fenced

Water: River

Recommended Lessee:

Conditions:

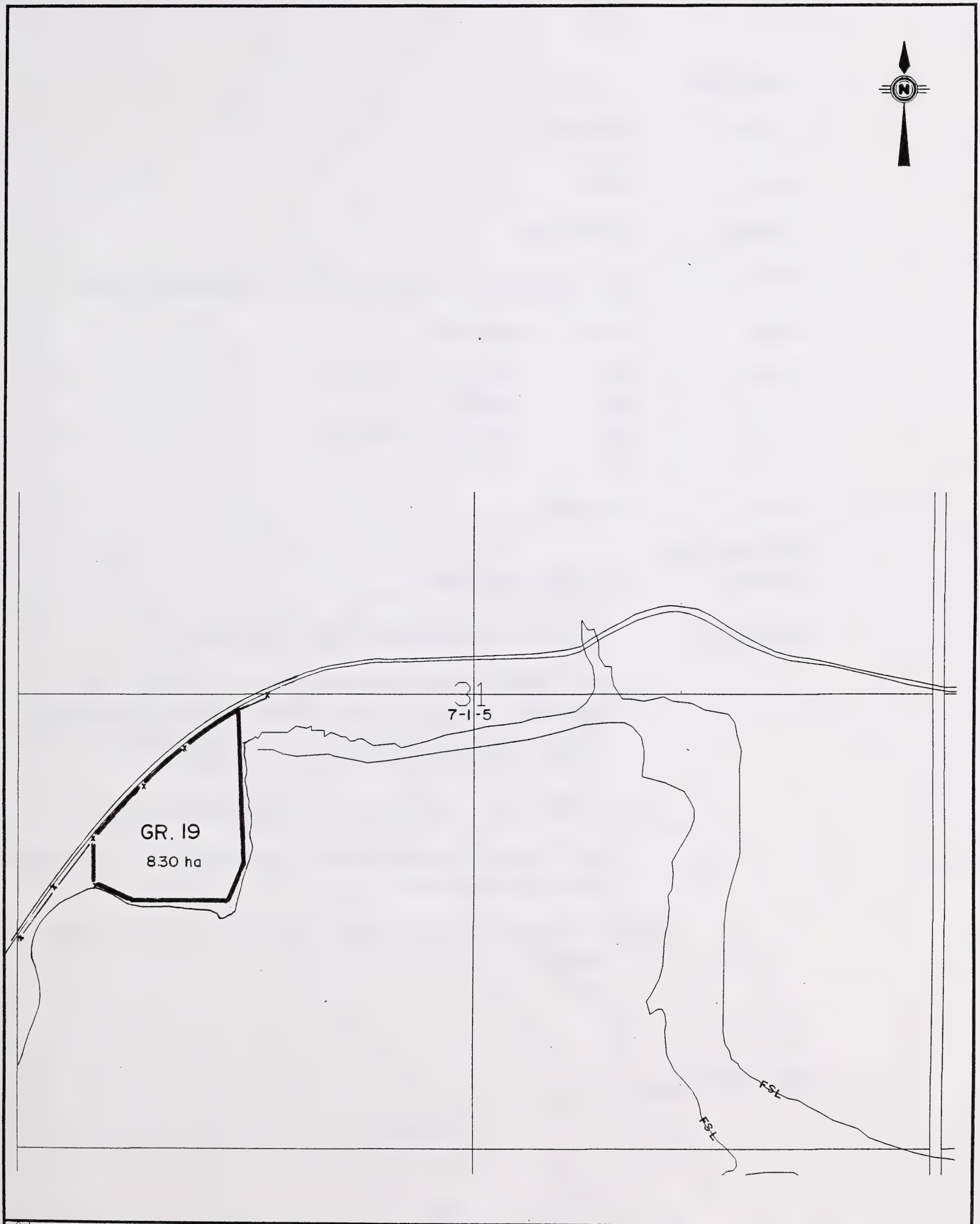
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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TITLE GRAZING MANAGEMENT PLAN
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AREA GR20

Location: SE3-8-1-5

Size: 37.2 ha

Capacity: 28 AUM/year

History: Native grassland historically grazed with adjacent parcels.

When: June 15 - August 15

Fencing:
West - Crossfence required
East - fencing
North - Crossfence required
South - fenced

Water: Reservoir

Recommended Lessee: No interest expressed

Conditions:

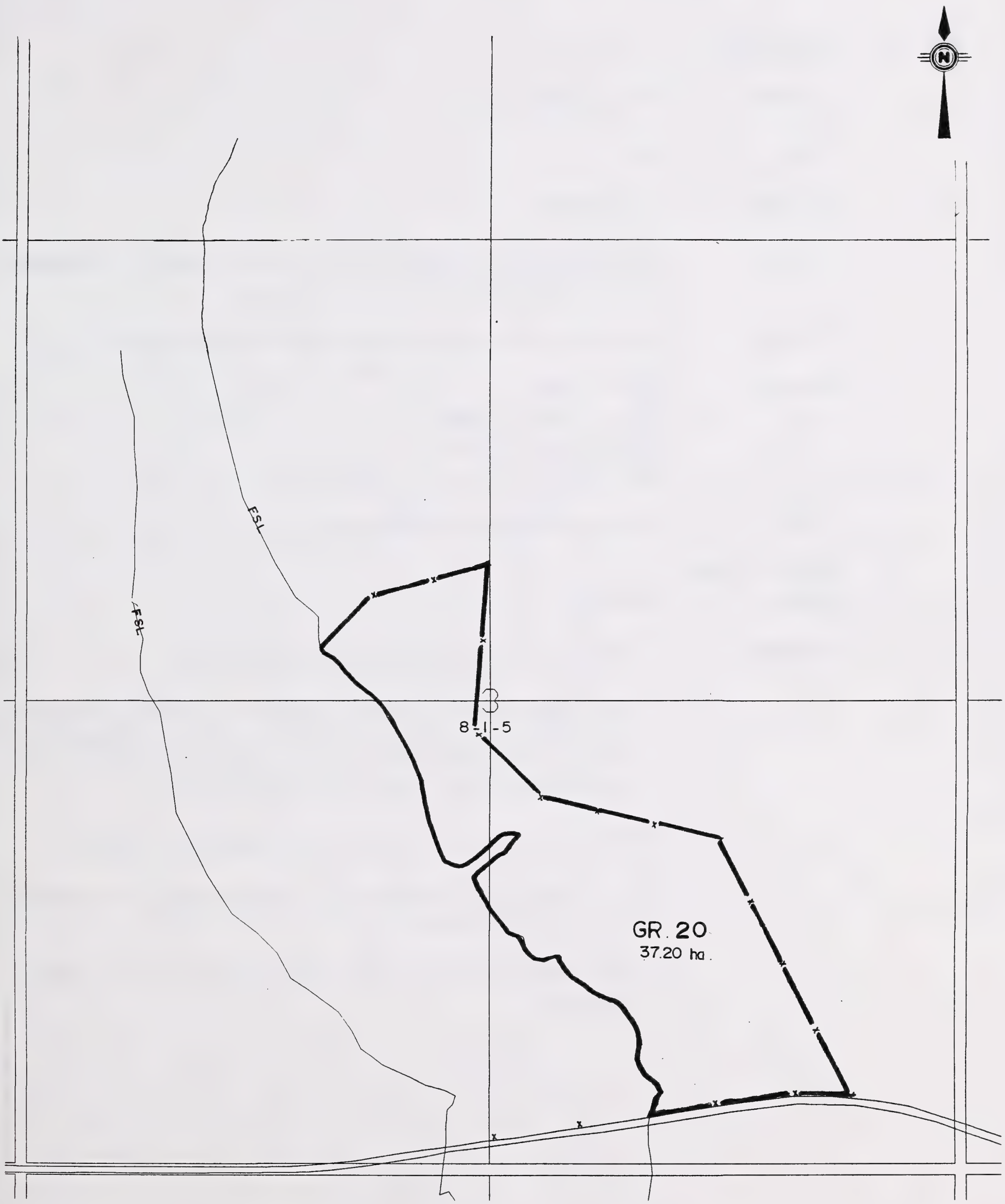
1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

5) The lessee shall not disturb trees and shrubs, or irrigation systems.



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AREA GR21

Location: SE25, NW24,-7-1-5

Size: 9 ha

Capacity: 5 AUM/year

History: This area is native grassland with brome invading. Mitigation projects exist west and south of the area.

When: Grazing should occur between June 15 and August 15

Fences:
North - Fence
West - Fence required
South - Fence required
East - Reservoir

Water: Water is available in the reservoir.

Recommended Lessee: Mr. Maloff

Conditions:

1) Pesticides are not permitted on any parcels.

2) Only spot spraying will be permitted to control weed on grassland. You must spray weeds under the direction of Alberta Environmental Protection if you are adjacent to the reservoir. Contact Terry lazarus at 627-5544.

3) Grazing shall be for a period not longer than 4 weeks.

4) The lessee is responsible for maintenance of all fences adjacent to the lease.

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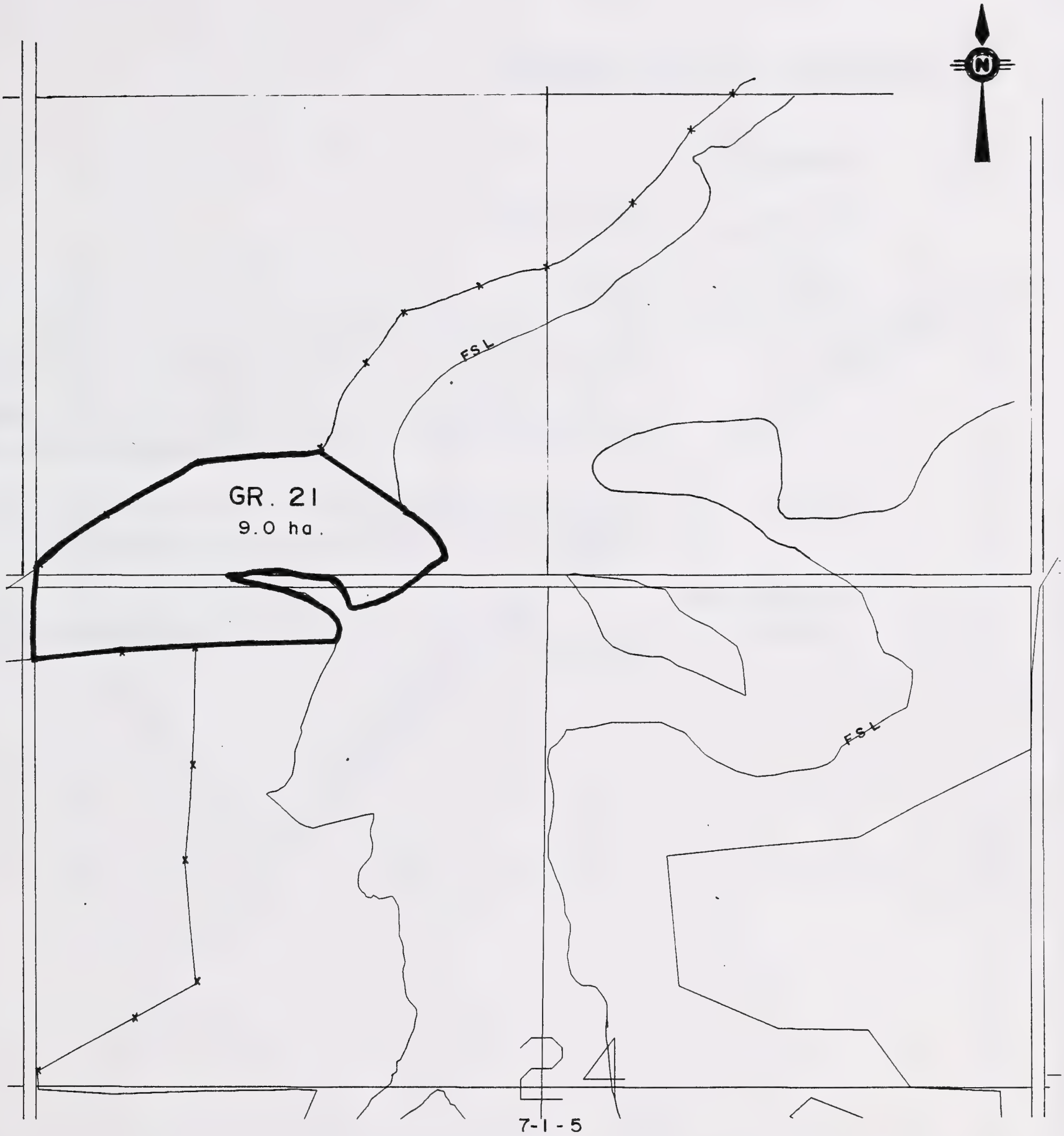

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PROJECT: OLDMAN RIVER DAM
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SECTION 2 - HAY/CULTIVATION

AREA HC0

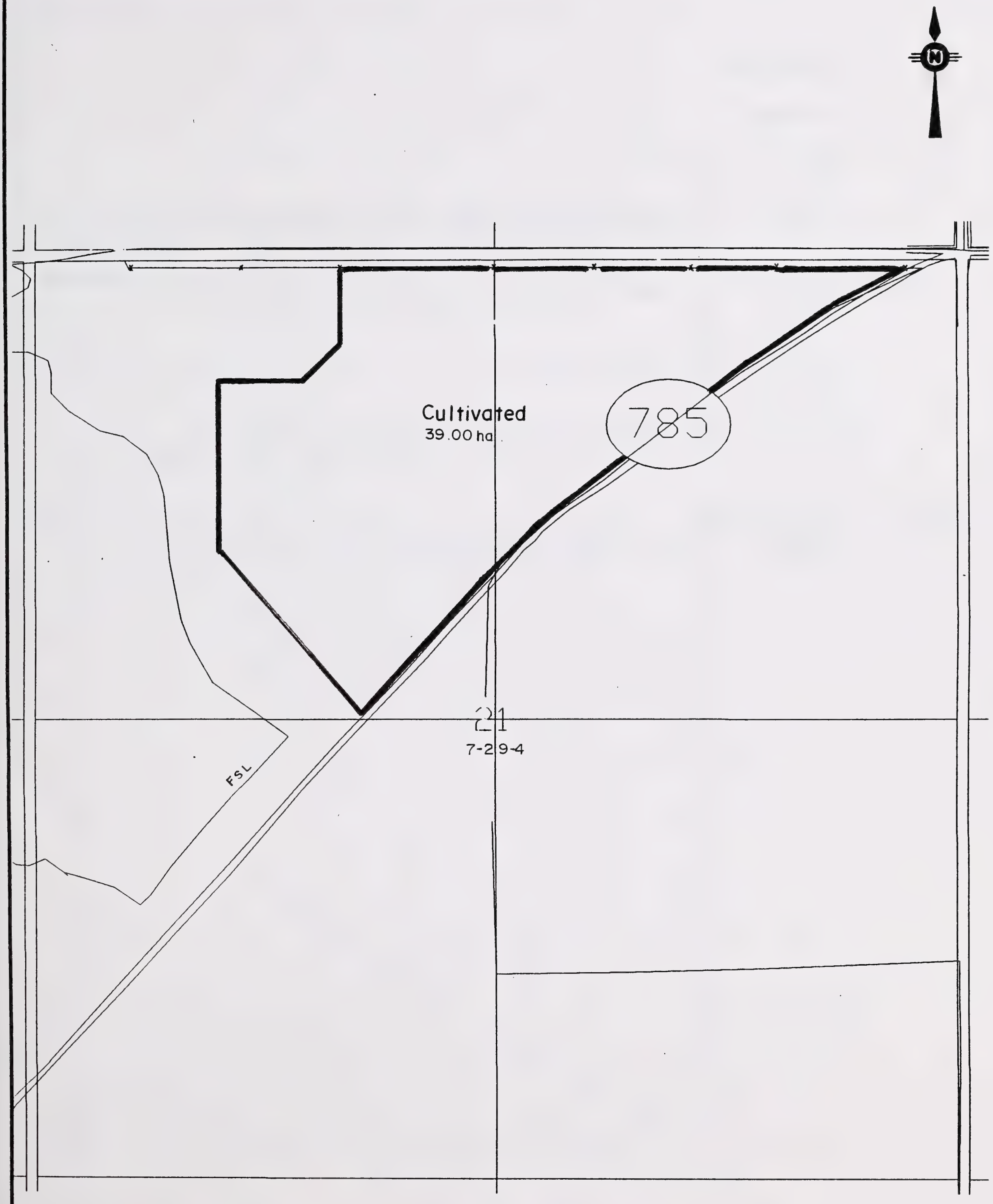
Location: N½-21-7-29-4

Size: 39 ha

History: This area has been cultivated throughout its agricultural history. It can be left in cultivation on seeded to hay. The Gifford farmstead should be left ungrazed for wildlife. If cultivated a bait strip equal to 25% of the crop should be left standing each year.

Permit: In lieu of the bait strip, no fee should be charged for this permit. Grazing should not be permitted after harvesting.

Recommended Lessee: Gerald Lewis farmed in the past. Roy Fairbrother may also be interested.



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AREA HC1

Location: SE30, NE19-7-29-4

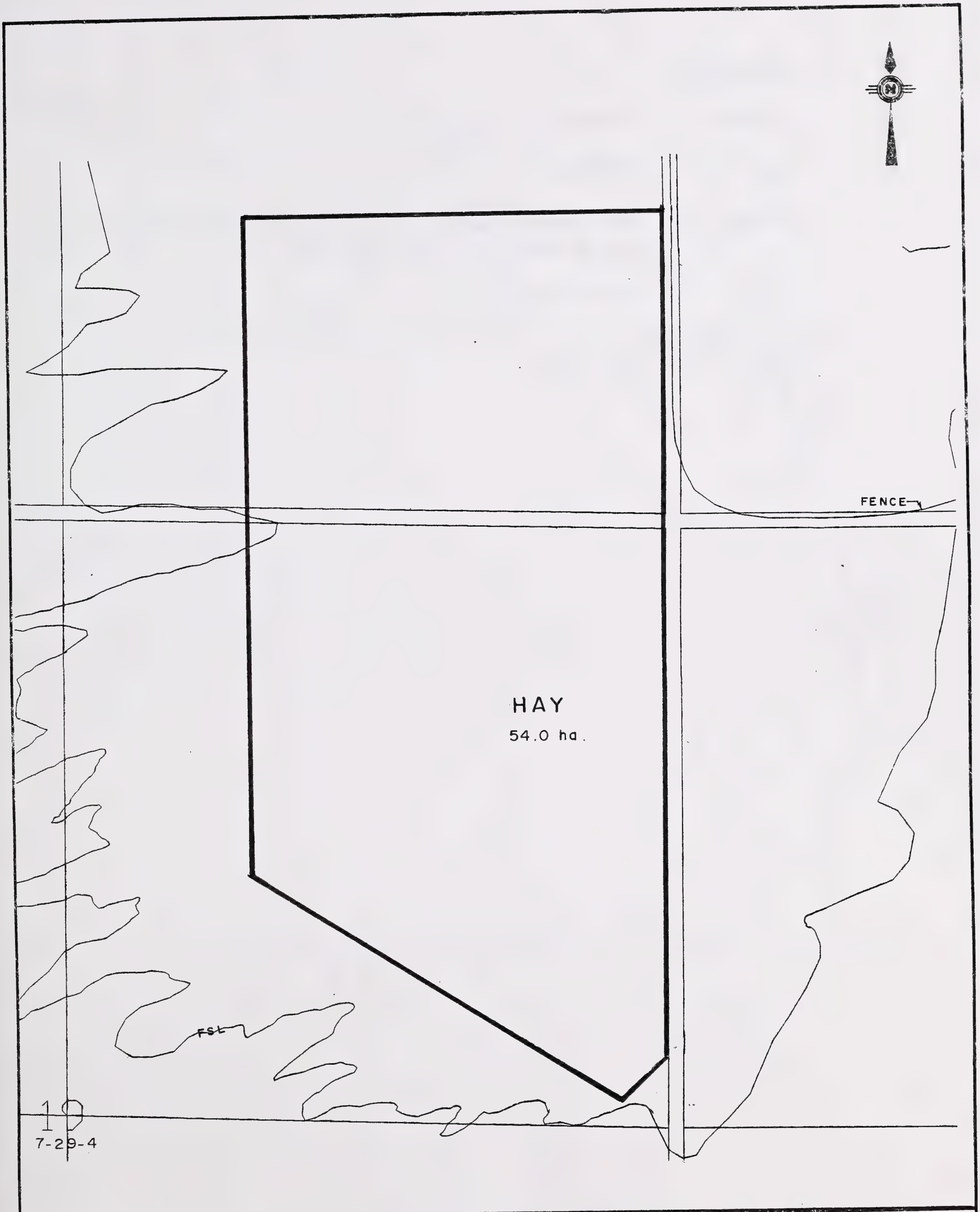
Size: 61 ha

History: This area can be hayed annually from July 15 to August 15. The area has planted trees along the north end and native vegetation along the shoreline. A 75 m buffer must be left along the planted areas. Only the cultivated portion can be hayed.

When: July 15 - August 15

Permit: In future this area may become a recreation site.
Hay permits should be issued annually upon request.

Recommended Lessee: Mr. Robbins hayed last few years. May be interested.



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AREA HC2

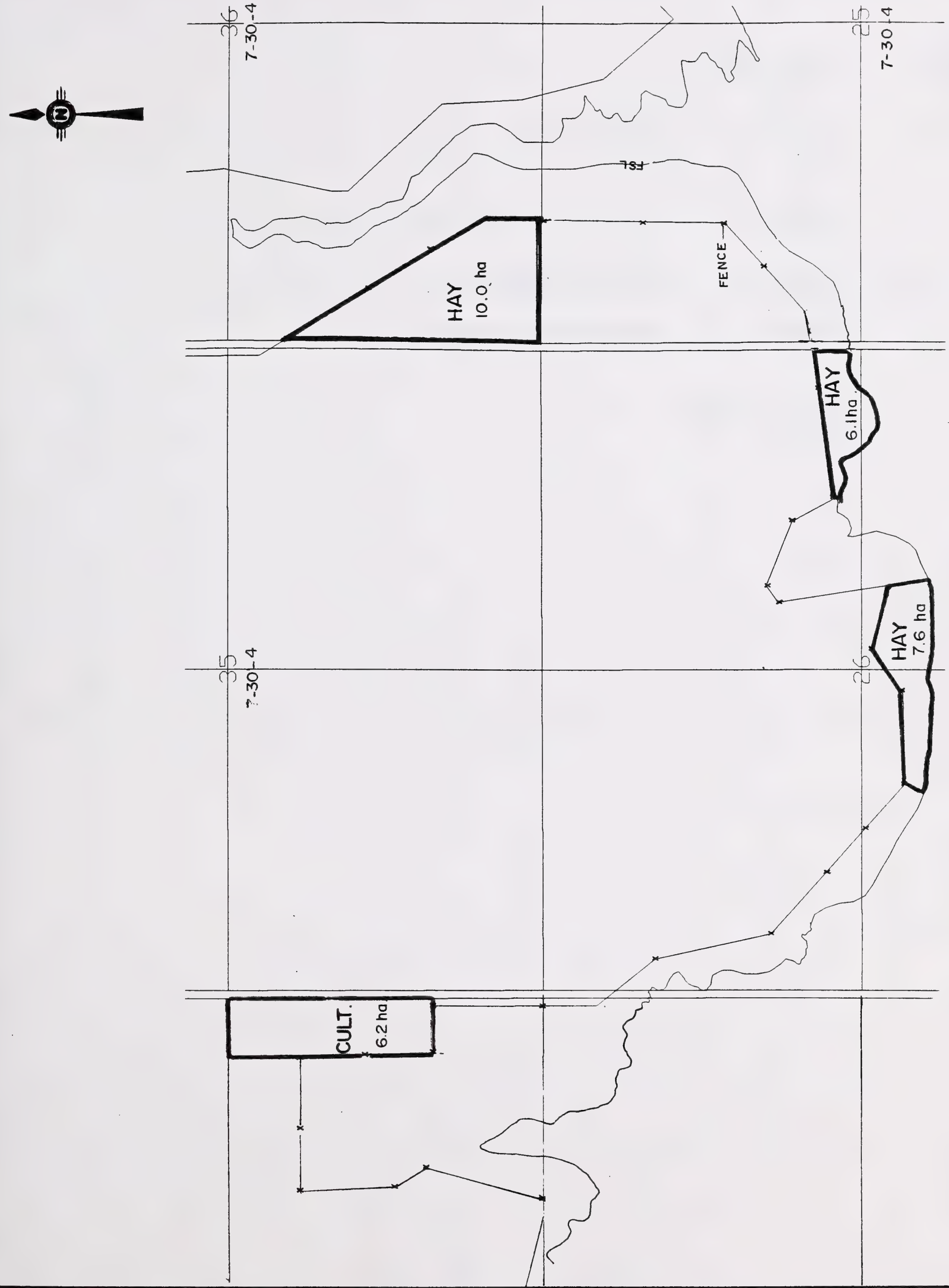
Location: SE34, SW 36, Sec 26, 30-7-4

Size: 10 ha; 6.1 ha; 7.6 ha; 6.2 ha

History: Four small parcels of seeded hayland exist in this area. These can be hayed on a permanent basis.

When: July 15 - August 15

Recommended Lessee: Mr. Schatz



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TITLE GRAZING MANAGEMENT PLAN
HC 2
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AREA HC3

Location: Sec 33-30-7-4

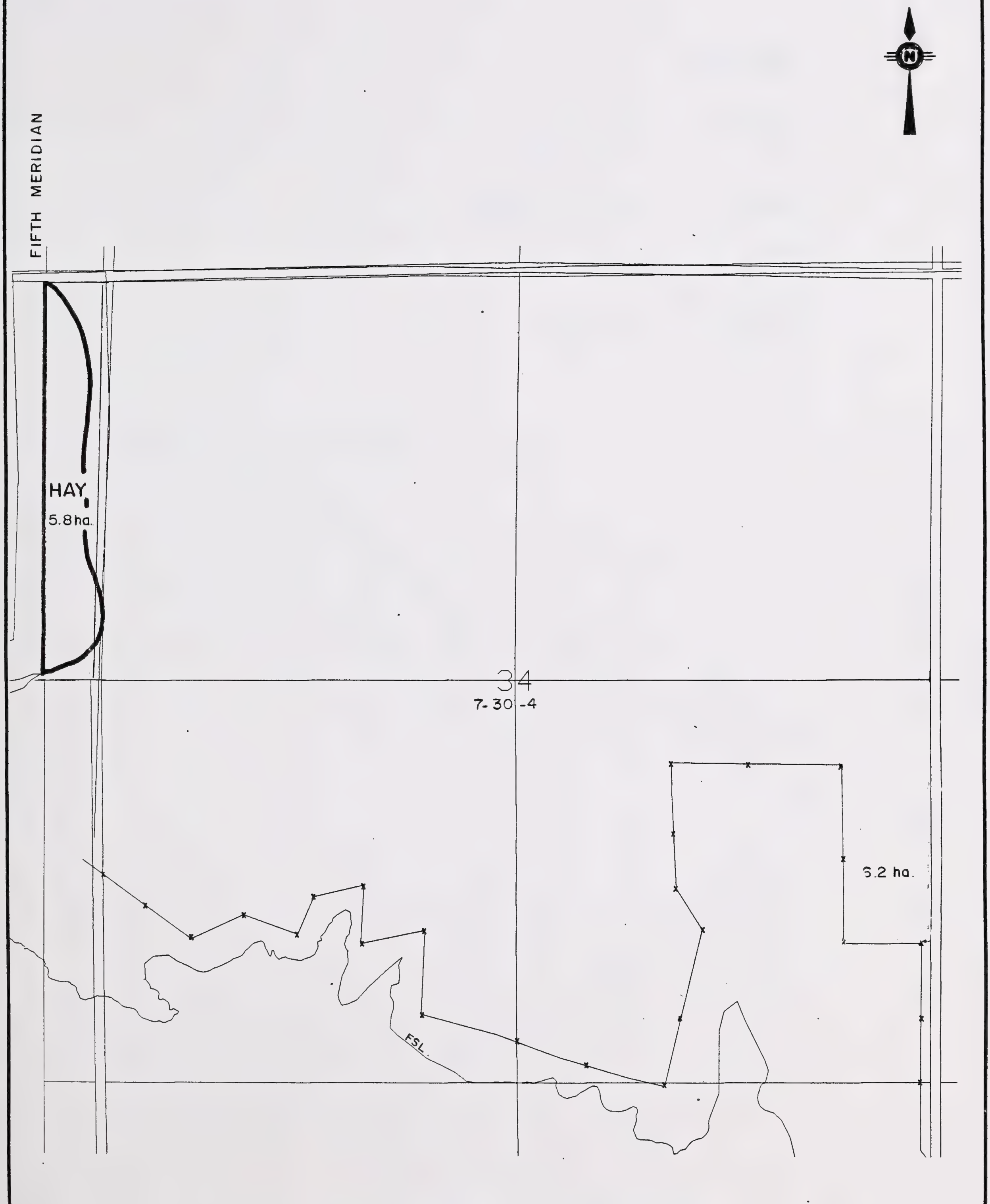
Size: 5.8 ha

History: Seeded Cultivation. Trees planted east side.

When: July 15 - August 15

Permit: Annually upon request

Recommended Lessee:



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PROJECT OLDMAN RIVER DAM

TITLE GRAZING MANAGEMENT PLAN
HC 3

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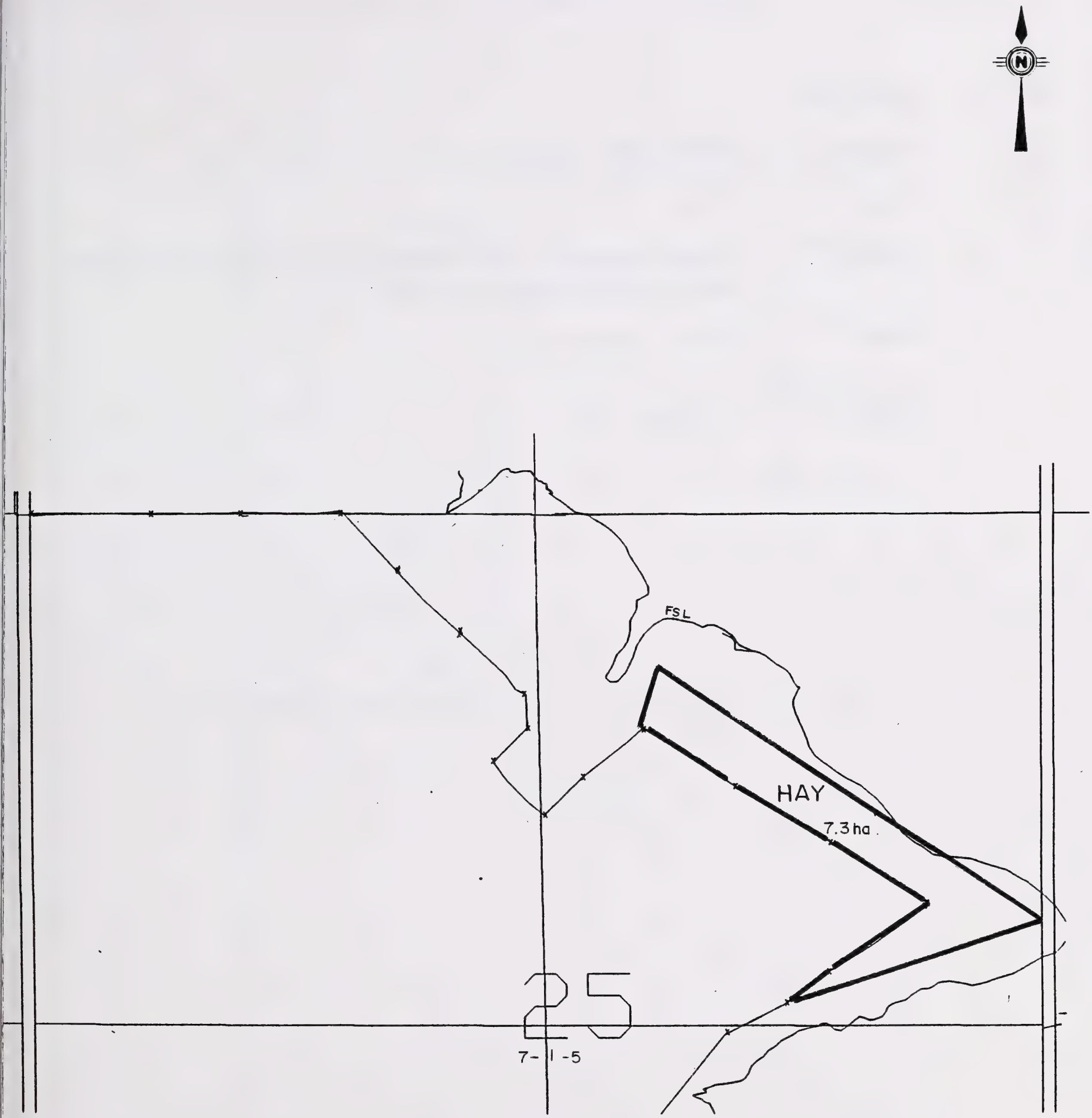
AREA HC4

Location:	Sec 25-1-7-5
Size:	5.3 ha; 7.8 ha
History:	Seeded cultivation
Where:	July 15 - August 15
Recommended Lessee:	Mr. Maloff



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HC 4
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DRAWING No. 53
REV

AREA HC5

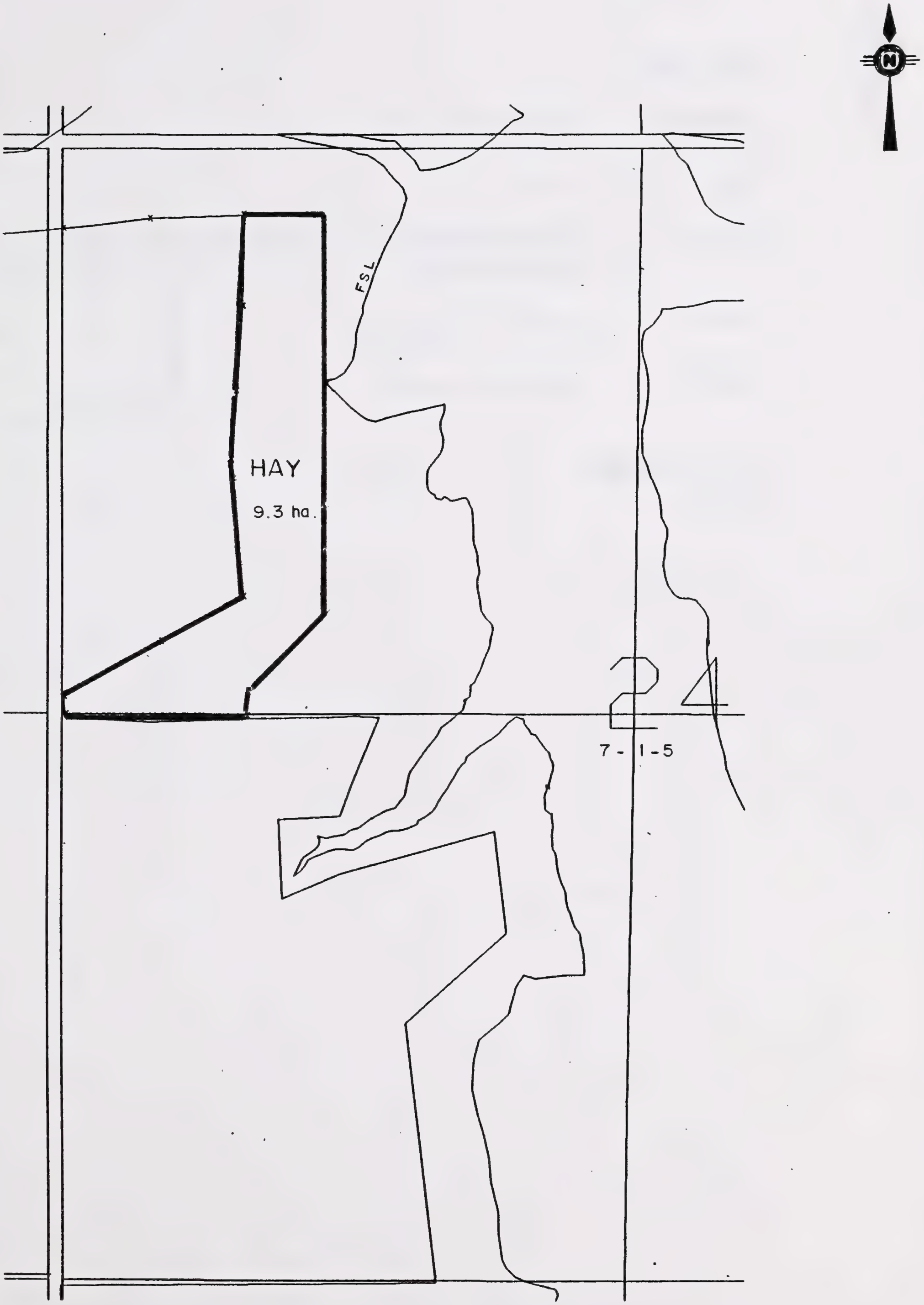
Location: NW24-1-7-5

Size: 9.3 ha

History: Seeded cultivation. Avoid planted trees and shrubs. Leave 75 m buffer to planted tress and shrubs

When: July 15 - August 15

Recommended Lessee: Mr. Maloff



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PROJECT OLDMAN RIVER DAM

TITLE GRAZING MANAGEMENT PLAN
HC 5

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AREA HC6

Location: NW13-7-1-5

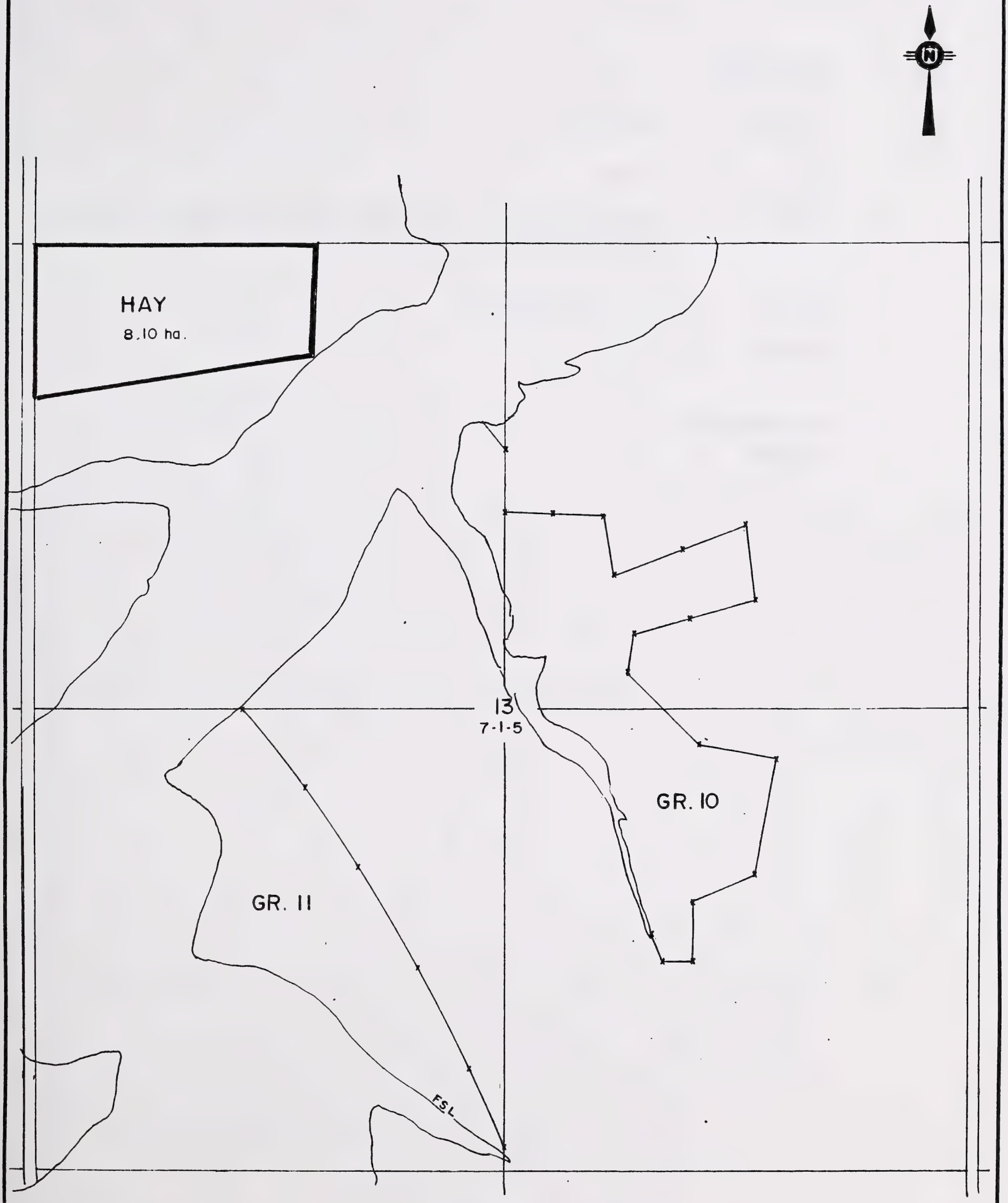
Size: 8.1 ha

History: Perennial hayland. Avoid planted trees and shrubs and surface irrigation lines.

When: July 15 - August 15

Permit: Annual on request

Recommended Lessee:



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DESIGNED BY COMPILED
APPROVED BY A. NILSON
DRAWN BY W.KNOL
CHECKED BY D.WILSON
SCALE N.T.S.

Alberta
PUBLIC WORKS, SUPPLY AND SERVICES
Reservoir Development Division
HON. KEN KOWALSKI
MINISTER

PROJECT OLDMAN RIVER DAM
TITLE GRAZING MANAGEMENT PLAN
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AREA HC7

Location: NW2-7-1-5

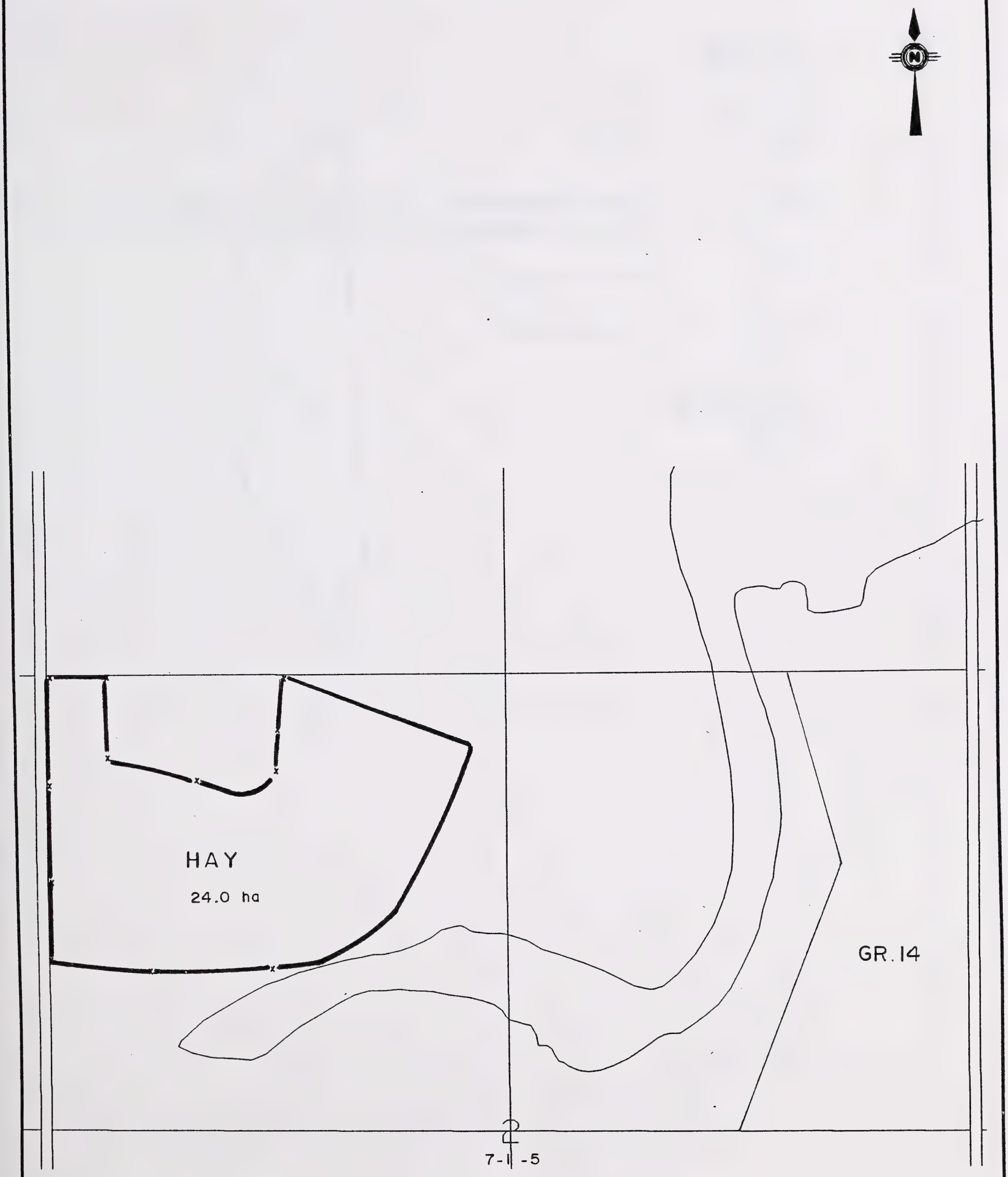
Size: 24 ha

History: Seeded cultivation. Permittee must avoid planted trees, snow fences, and water lines.

When: July 15 to August 15

Permit: Annual

Recommended Lessee:



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AREA HC8

Location: NW3-8-1-5

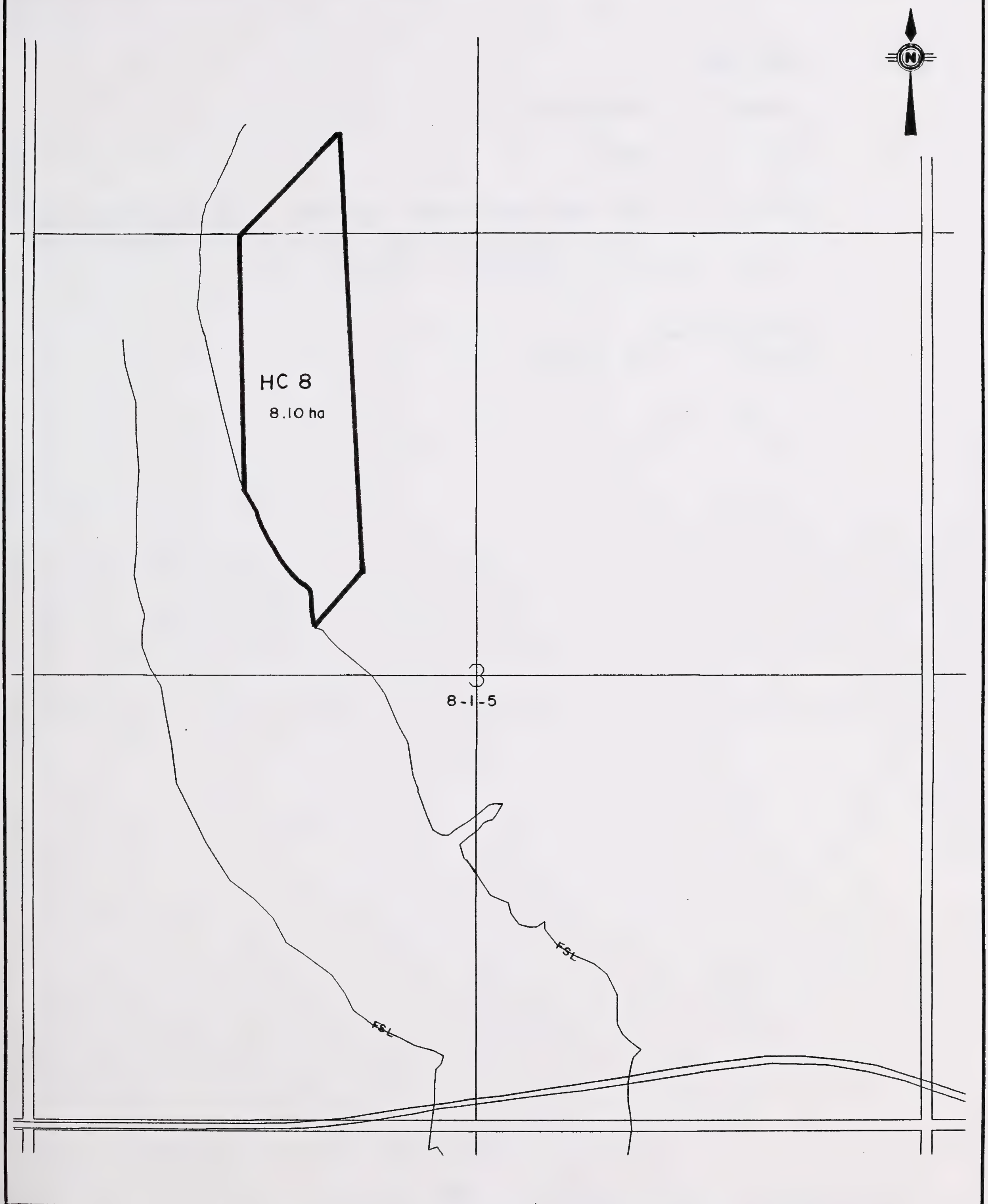
Size: 8.1 ha

History: Irrigated Seeded hay. Avoid planted trees and shrubs. Leave 75m buffer between reservoir and haying.

When: July 15 - August 15.

Permit: Annual permit.

Recommended Lessee:



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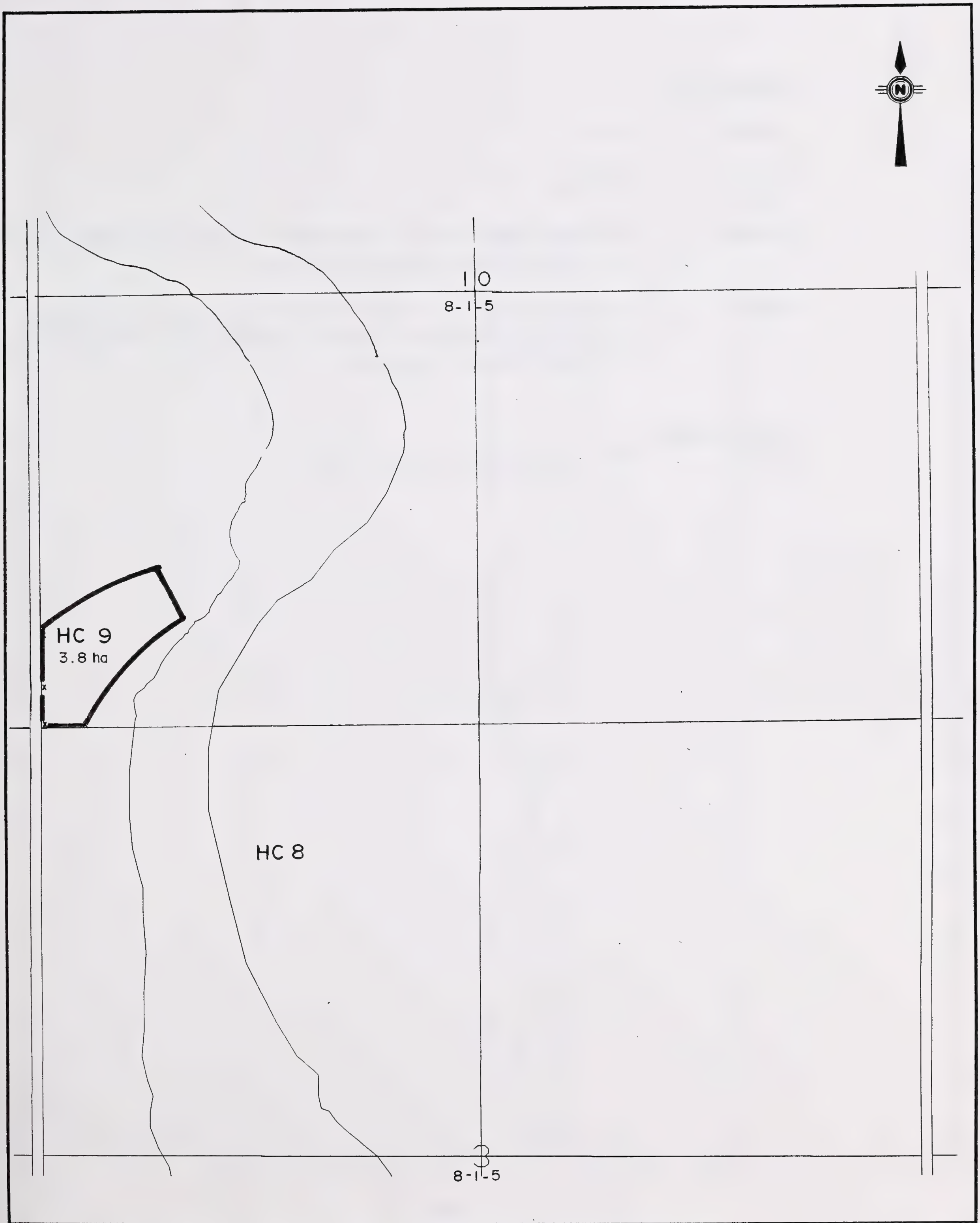
AREA HC9

Location:	SW10-8-1-5
Size:	3.8 ha
Permit:	This area should remain in cultivation. A bait strip of 25% of the crop should be left standing. No fee should be charged for this permit. Grazing is not permitted.
Recommended Lessee:	Mr. Smythe



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HC 9

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AREA HC10

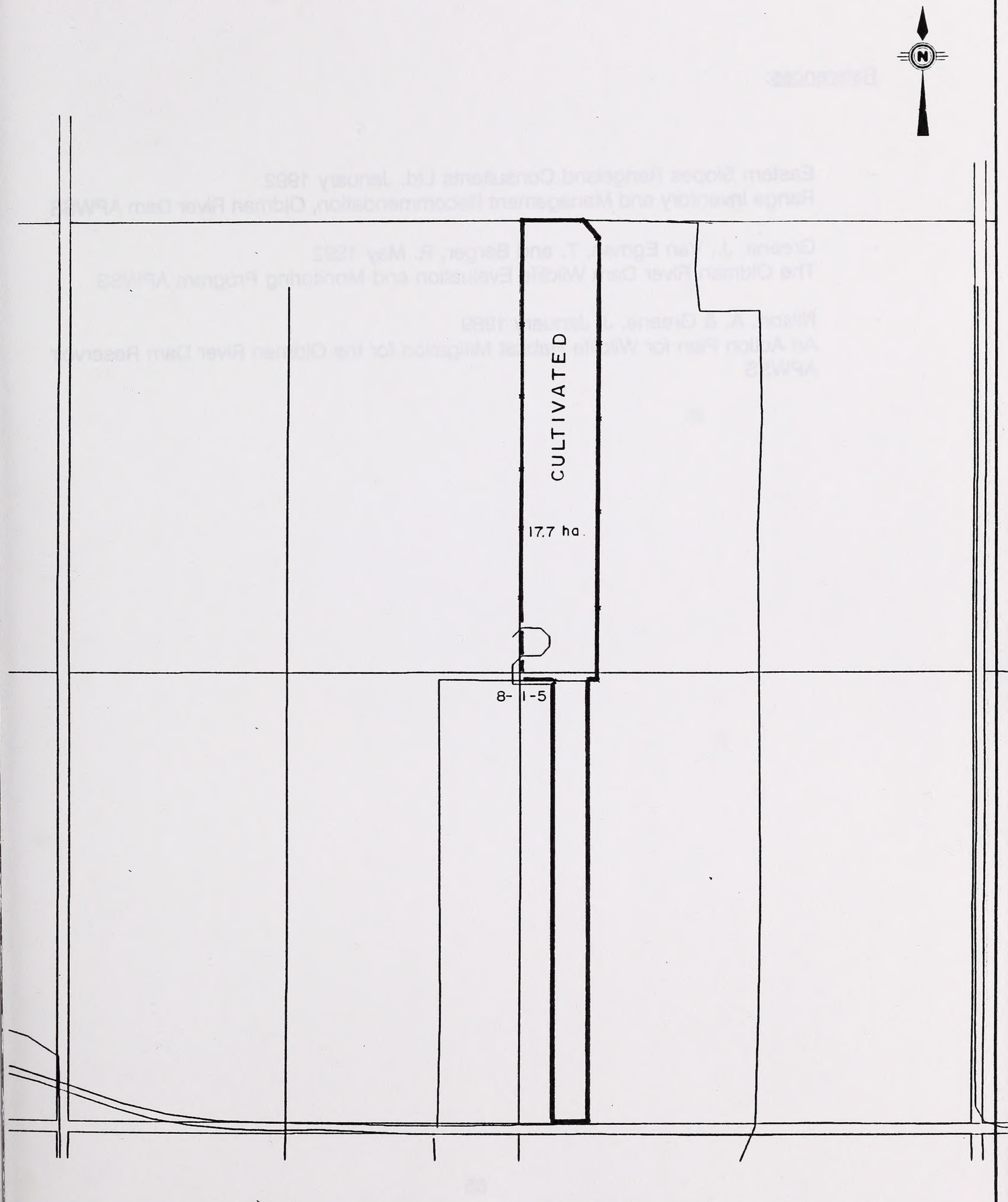
Location: 2-8-1-5

Size: 17.7 ha

History: This area should remain in cultivation. A bait strip of 25% of the crop should be left standing each year.

Permit: In lieu of the bait strip no fee should be charged for this permit. A long term arrangement should be established. Grazing should not be permitted on this parcel.

Recommended Lessee: Mr. Heaton cultivated in the past



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PROJECT OLDMAN RIVER DAM
TITLE GRAZING MANAGEMENT PLAN
HC 10
DATE JAN. 1993
SHEET 1 OF 1
DRAWING No. 65
REV.

References:

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  Range Inventory and Management Recommendation, Oldman River Dam APWSS
- Greene, J., Van Egman, T. and Berger, R. May 1992
  The Oldman River Dam Wildlife Evaluation and Monitoring Program APWSS
- Nilson, A. & Greene, J. January 1989
  An Action Plan for Wildlife Habitat Mitigation for the Oldman River Dam Reservoir APWSS

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